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THE AMERICAN JOURNAL OF ROENTGENOLOGY

Editor, James T. Case, M.D., Battle Creek, Mich.

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LATERAL ROENTGENOGRAPHY OF THE SPINE*

BY PRESTON M. HICKEY, M.D.

DETROIT, MICHIGAN.

IT has been an axiom with experienced roentgen ray practitioners that all fractures should be rayed in two planes at right angles to each other, or, preferably, stereoscopically in one or two directions.

The examination of the spine has always presented difficulties in its demonstration upon the roentgen plate. On account of the technical difficulties encountered in making plates laterally, most of us have been content to make stereoscopic plates in the anteroposterior direction. The difficulties which arise embrace, first, the problem of suitable penetration, and, second, the natural exaggeration due to the distance of the examined part from the plate. Thanks to the improvement in tubes in the last few years, we fortunately now have apparatus at our disposal which afford sufficient penetration for an adequate length of time to satisfactorily radiate the body from side to side. Of course, the use of screens furnishes an additional means with which to accomplish this purpose. Their use, naturally, should not be resorted to except when absolutely necessary.

The second technical point, viz., distortion, can be obviated by increasing the distance between the tube and the patient. In spite of the statements of the theoretical school, I am one of those who believe in the use of the tubular type of diaphragm to obviate secondary rays produced in the body. I do not think this can be accomplished with the simple flat diaphragm, unless the vacuum of the tube and the consequent necessary voltage are exactly suited to the part of the body to be penetrated, so that the penetration may take place with a minimum formation of secondary rays. We have found of the greatest use an extension diaphragm (Fig. 1).

Ever since 1910, the writer has made it a custom to ray patients who have suffered traumatism of the spinal column in the anteroposterior direction, stereoscopically, and in the lateral direction. I do not consider that the flat plate gives sufficient accentuation to the pathology which is so often present.

Injuries to the spine may, in general, be divided into two great groups: first, those which affect the cord-protecting portion of the spine and, second, those which affect the weight-bearing function of the spine. In this latter group are to be classed the compression fractures of the bodies of the

* Read at Seventeenth Annual Meeting of the American Roentgen Ray Society, at Chicago, Ill., Sept. 27-30, 1916.

FIG. 1. EXTENSION DIAPHRAGM TO MINIMIZE DISTORTION.

vertebræ which may be present with considerable change, without any interference with the functions of the cord, causing the patient pain on movement and distress on walking or exercising. These fractures of the bodies of the vertebræ may be of all degrees of severity from a minute spicule of bone which can hardly be seen on the roentgen plate, and which rather belongs to the so-called sprain fracture, to those aggravated cases where there is a marked destruction of the spongy body of the vertebræ.

FIG. 2. LATERAL SPINE WITH SMALL SPICULE OF BONE BETWEEN NINTH AND TENTH DORSAL VERTEBRÆ.

In Fig. 2, we note on close inspection, between the lower anterior edge of the ninth and the upper anterior edge of the tenth dorsal vertebræ, a small rounded spicule of bone which exactly corresponded to the patient's complaint of pain following traumatism, and which showed no roentgen evidence of its presence on the stereoscopic anteroposterior plates.

An illustrative case of a severe type of injury is furnished by a patient with the following history: Comparatively slight injury to the back while engaged in factory

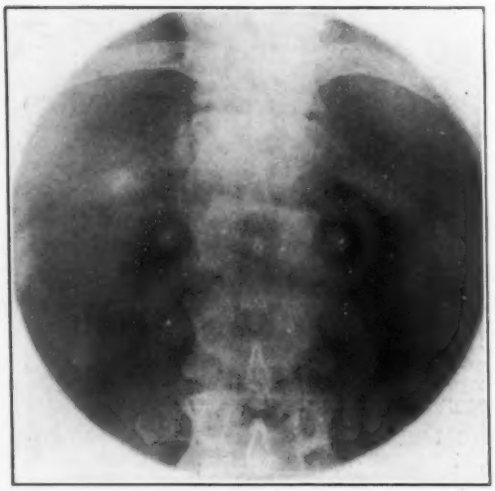

FIG. 3. ANTEROPOSTERIOR PLATE OF COMPRESSION FRACTURE OF FIRST LUMBAR. (SEE FIG. 4.)

work. Subsequent examination by the factory physician, with a report to the company of probable malingering. The patient, however, complained of such pain on attempts at walking, that he was referred by the factory physician for examination. The anteroposterior plate (Fig. 3) showed an obliteration of the articular space between the first and second lumbar vertebræ. Careful study with the stereoscope did not reveal the extent of the traumatism, until a comparison was made with the lateral plate (Fig. 4). Here we have a complete crushing-in of the anterior three-fourths of the first lumbar vertebra, with a subsequent interference with the weight-bearing function of the

FIG. 4. LATERAL PLATE OF COMPRESSION FRACTURE OF THE BODY OF THE FIRST LUMBAR. (SEE FIG. 3.)

FIG. 5. ANTEROPOSTERIOR PLATE OF COMPRESSION FRACTURE OF FIRST LUMBAR. (SEE FIG. 6.)

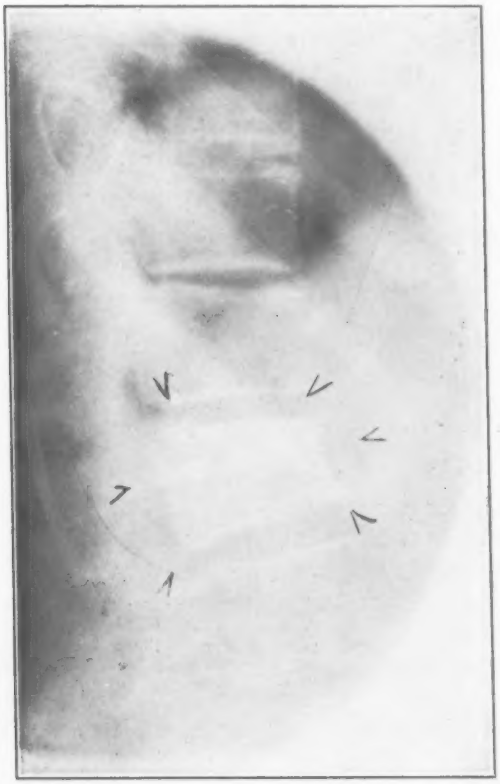

FIG. 6. LATERAL PLATE OF COMPRESSION FRACTURE OF FIRST LUMBAR. (SEE FIG. 5.)

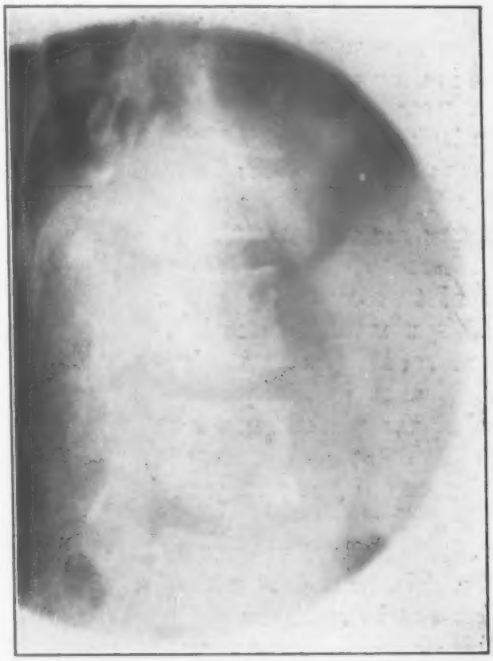

FIG. 7. LATERAL PLATE OF COMPRESSION FRACTURE WITH DISLOCATION.

FIG. 8. LATERAL PLATE OF COMPRESSION FRACTURE MADE TWELVE HOURS AFTER INJURY. (PORTABLE COIL WITH SCREEN.)

spine. The patient's extreme symptoms were relieved by an Albee operation.

The anteroposterior plate of a similar case is shown in Fig. 5. In the next (Fig. 6), we see a partial destruction of the first lumbar vertebra.

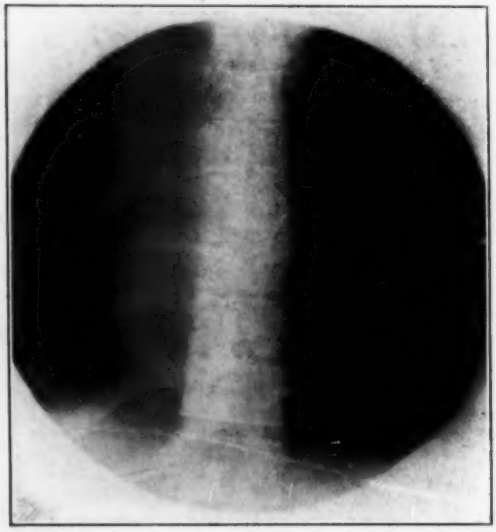

FIG. 9. ANTEROPOSTERIOR PLATE; NEGATIVE FINDINGS. (SEE FIG. 10.)

In Fig. 7, we find a slight compression fracture with a backward dislocation. This, of course, was attended with some injury to the articular facets, but the displacement was only to be emphatically seen in the lateral view.

Fig. 8 is thrown upon the screen with some apologies, as it is not technically a good plate. However, it was made with a small portable outfit in the patient's bed, inasmuch as his condition would not permit of his removal to a roentgen laboratory. The plate was made within twelve hours after the injury, and demonstrates a point which has been under some discussion as to whether the appearances, which we have been noting above, are not due to late bone atrophy and absorption. Of course, in fractures of the neck of the femur there is absorption in the neck where there is an injury to the nutrient artery and interference with the circulation. It has been thought by some that these conditions imparting a triangular shape to

FIG. 10. LATERAL PLATE; NEGATIVE FINDINGS. (SEE FIG. 11.)

the bodies of the vertebræ after traumatism are due to atrophy through interference with the circulation. This plate shows a triangular appearance of the body of the second lumbar vertebra, and inasmuch as the examination was made within a very few hours after the accident, it would seem to prove that these compressions of the vertebræ occur at the time of injury.

On account of the fact that slight injuries to the vertebræ are not conspicuous in the anteroposterior plate, the lateral plate enables us to indulge in a negative diagnosis with more assurance of our correctness. In Fig. 9, we find an antero-

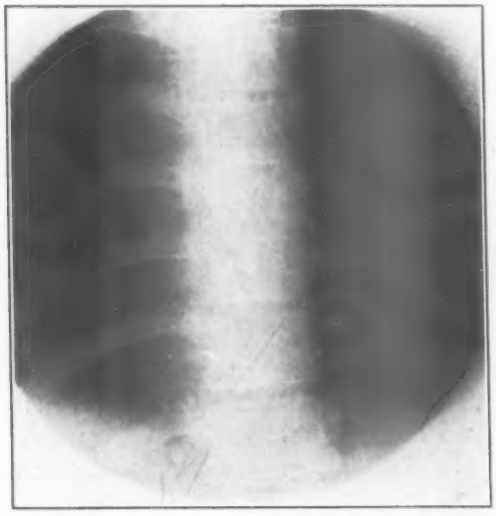

FIG. 11. ANTEROPOSTERIOR PLATE OF COMPRESSION FRACTURE. (SEE FIG. 12.)

posterior view of a painful post-traumatic spine which seems to be quite negative in its findings; in Fig. 10, we have a lateral view of the vertebræ under discussion which confirms the negative report.

One recently examined case has a touch of realism. The patient was a young medical officer who was about to cross the seas for medical service after a long period of training, when he met with a railroad accident. Physical examination of his back revealed no evidence of injury, although he was examined by some eight or ten medical men. As he still felt that his physical condition would not warrant his

FIG. 12. LATERAL PLATE OF COMPRESSION FRACTURE (SEE FIG. 11.)

entering service, he was in a quandary between attempting to do military duty with a physical disability or being subjected to the stigma of cowardice. An anteroposterior plate (Fig. 11) shows a slight change between the eighth and tenth dorsal vertebræ. A lateral plate (Fig. 12) shows a very marked example of compression fracture. It would have been difficult

FIG. 13. LATERAL PLATE OF HYPERTROPHIC ARTHRITIS.

FIG. 14. LATERAL PLATE OF CERVICAL VERTEBRÆ WITH CARCINOMATOUS METASTASES (PORTABLE OUTFIT).

to have convinced his medical superiors who might not be familiar with the anteroposterior views of compression fractures of the gravity of the injury, but the lateral view was sufficient at the first glance.

In Fig. 13, we find a marked accentuation of the upper and anterior angle of the body of the eighth dorsal vertebra. This patient gave a history of rheumatism of the back, and the ordinary anteroposterior plates did not show the lesion of hypertrophic arthritis.

The last, Fig. 14, which shows the cervical vertebræ, and for the appearance of which I would also apologize, being made with a portable outfit with the patient in bed, shows marked destruction of the second and third cervical vertebræ, due to a metastasis secondary to carcinoma of the breast. This case illustrates the fact that any patient with symptoms in a bony part is worthy of investigation with the ray, inasmuch as the first inspection of the case did not seem to give any clue as to the real pathology which was present.

Summarizing this short paper, I wish to call attention to the fact that many lesions of the spine which are inconspicuous or almost unobservable on the anteroposterior plate, will show a good clear reading on the lateral view of a definite pathology and that consequently a lateral examination of the spine should be made a routine laboratory rule.

OBSERVATIONS ON THE ROENTGEN APPEARANCES OF OSTEOMYELITIS*

BY ROLAND HAMMOND, M.D., F.A.C.S.

PROVIDENCE, R. I.

A PERUSAL of the textbooks on roentgenology published no longer than a decade ago shows but a few lines devoted to the roentgenological appearance of osteomyelitis. The more recent ones have aided but little in giving us a clear-cut conception of this disease in its various manifestations. Nor is the writer sanguine enough to believe that he can add to the sum total of our knowledge on this subject. An attempt to clear up a few of the puzzling features met with in the differential diagnosis of osteomyelitis is the only excuse for presenting such a paper in an assemblage of roentgenologists.

The term osteomyelitis has been used to cover any inflammation of bone whether of pyogenic, tuberculous, syphilitic or other origin. Although strictly speaking a disease of the medulla, it soon involves the cortex and periosteum, and is liable to be confused with lesions which are more closely identified with the two latter structures.

The typical, well advanced case of osteomyelitis is recognized at a glance, both clinically as well as roentgenographically. It is when we have to deal with early cases and those of atypical appearance that interesting points in differential diagnosis are brought out. The earliest appearance on the roentgen plate is usually an increased radiability at some one point. Unfortunately, this does not usually occur early enough in the disease to be of value to the surgeon or medical attendant. Several days at least are required for the absorption of a sufficient quantity of lime salts so that an area of increased radiability will be demonstrable on the plate. When pus forms and breaks through the cortex, there is produced a slight elevation of the periosteum at this point. Beyond this stage the disease manifests itself in a hundred different ways from total destruction of bone to the formation of dense sequestrum and involucrum. In all of these later stages the diagnosis is easily made. Destruction of the endosteum results in areas of increased radiability varying in size and appearance. Stripping up of the periosteum gives rise to a deposit of irregular outline and varying density which later becomes the involucrum. Invasion of the muscle sheaths by the infection, especially in the thigh, result in the ribbon-like formations of increased density, seen often separated at some distance from the bone.

It is rather the atypical forms to which I wish to call attention. A localized, definitely circumscribed area of increased radiability occurring in the juxta-epiphyseal portion of the bone in children is commonly known as Brodie's abscess. It is oval in shape, has a clear-cut bony wall and is most often seen at the upper end of the ulna or the tibia. The roentgen appearance would suggest a cyst, but the pain, localized tenderness, limitation of joint motion and elevation of temperature are more marked than usually obtains in a case of simple bone cyst.

While the roentgen appearance of pyogenic osteomyelitis is fairly typical in the ordinary case, it is likely at times to be confused with certain stages of tuberculosis and syphilis. It may be necessary to settle the question by laboratory tests or the histological examination of the bone in question in order definitely to settle the diagnosis.

Tuberculosis usually produces rarefaction of bone throughout a joint, in which the cortex is affected as well as the softer portion of the bone. Conversely, syphilis

*Read at the Seventeenth Annual Meeting of the American Roentgen Ray Society, Chicago, Sept. 27-30, 1916.

most commonly results in a deposit of hard dense bone just beneath the periosteum. Both of these characteristics may be found in osteomyelitis. Thus we may have rarefaction combined with overproduction of cortical bone or periosteum.

In the case of osteomyelitis the overgrowth is more excessive and irregular in outline than is seen in syphilis, and the rarefaction is usually more definite and circumscribed than is found in cases of tuberculosis.

FIG. 1. OSTEOMYELITIS OF RIGHT TIBIA. (Case 1.)

Condition in June, 1916, one month after onset, showing beginning involvement of internal malleolus.

A bone tuberculosis which is complicated by secondary infection from pyogenic organisms will give the typical picture of a frank osteomyelitis. In such a case it is not possible from roentgen examination alone to determine the exact pathological condition without the aid of laboratory examination of the bone, and even then the secondary infection may have been overwhelming enough to have obliterated the evidences of tuberculosis.

The following cases are of interest in this connection:

CASE 1. V. M., aged 35, in previous good health, had a sudden attack of pain followed by swelling in the right ankle in May, 1916, which later increased in severity. Roentgenograms taken one month later showed a very slight indefinite area of increased radiability just above the internal malleolus. He was admitted to my service in the Rhode Island Hospital August 5, 1916. There was uniform thickening over the lower end of the tibia and

FIG. 2. OSTEOMYELITIS OF RIGHT TIBIA. (Case 1.)

Condition in August, 1916, three months after onset, showing rapid involvement of bone and progression up the shaft with proliferation of periosteum.

upper part of the ankle joint with two sinuses discharging thin pus. Roentgenograms taken two months after the first series showed considerable destruction of the lower third of the tibia and os calcis, with loss of cortex in some places and proliferation in other areas. Subcutaneous tuberculin and Wassermann tests were negative. Roentgenograms made three weeks later showed further marked destruction of the tibia and tarsal bones. Bone removed from the tibia for examination showed only chronic osteomyelitis, no tuberculosis being found.

Here is a case in which the roentgenograms pointed to tuberculosis. On the other hand, the fairly rapid onset, the location and appearance of the diseased area in the tibia and the laboratory examinations, all seemed to favor pyogenic osteomyelitis.

CASE 2. E. W., aged 9, entered my hospital service Aug. 15, 1915, with the diagnosis of tuberculous disease of the left hip. Examination showed but slight spasm of muscles or limitation of motion in that hip. There was a history of pains throughout the body, the mother had had two miscarriages, and a Wassermann test was strongly positive. The roentgenogram shows the femur to be wider and denser than the normal. The distinction between the cortex and medulla is not clearly made out, and there are areas of varying density throughout the shaft. The periosteum is thickened on the inner side of the shaft. Although possessing a few points suggestive of osteomyelitis, the roentgen evidence is overwhelmingly in favor of its being syphilis.

CASE 3. F. G., aged 9, seen four months after a fall from a car. Swelling and pain in the left knee and left wrist. Wassermann test negative. The wrist was incised and tissue removed which contained giant cells. The tissue showed necrosis and had lost its staining power. The pathologist stated that it was consistent with either tuberculosis or syphilis. The roentgenogram shows proliferation of the periosteum without noticeable changes in the cortex or medulla.

CASE 4. B. P., aged 3, entered my hospital service June 20, 1916, with dactylitis of the left hand and right foot. Wassermann test negative, Von Pirquet test positive. Pus from the sinuses contained no tubercle bacilli, and cultures of staphylococcus aureus were grown from this pus. The roentgenogram shows marked proliferation of dense bone on the outer side of the third metatarsal and considerable rarefaction of the fourth metatarsal bone.

The last two cases are examples of the osteomyelitis which is commonly seen as a dactylitis, either tuberculous or syphilitic in nature. In Case 3, if we consider only tuberculosis and syphilis as possible diagnoses, the former seems the more likely, since the Wassermann test is negative. On the other hand it is uncommon to see tuberculosis in children in joints so widely separated as the knee and wrist. It is possible that the diagnosis of infectious osteomyelitis will explain all the findings better than any other. Case 4 is undoubtedly tuberculosis, but is shown to illustrate the overgrowth and rarefaction of bone present in the same foot.

The roentgen diagnosis of osteomyelitis is easily made in the typical cases. It is easily mistaken for other chronic bone diseases such as tuberculosis and syphilis, and it may require a careful survey of laboratory and clinical findings before an accurate diagnosis is reached.

A BROADER RELATIONSHIP BETWEEN ROENTGENOLOGY AND THE VARIOUS THEORIES OF SYSTEMIC DISORDER FROM LOCALIZED SOURCES*

BY PERCY BROWN, M.D.

BOSTON, MASS.

IN spite of the magnanimity of our President that made it possible, what excuse, indeed, can a reader offer to justify the setting aside of the matter with which he purposes to deal, in favor of another in nature apparently variant? A sense of the growing importance of the subject to be substituted, as against the minor nature of the one to be displaced, is, perhaps, not an unreasonable justification, and, as such, it must be offered, in part at least, at the present moment.

Moot points arise in all forms of scientific discussion—questions of procedure, perhaps, the import of which at first glance recommends their support to the disregard of others which, in their turn, may have enjoyed equal recognition. If, by the tests of time and usage, such favor be merited, it is well for the advancement of a science. In our allegiance to that which is new in theory or practice, let us not snuff out our recognition of those things which time and usage have made equally valuable, and which may underlie, in principle or application, the newer and more attractive methods or ideas.

Is there a roentgenologist in this company who has not been caught in the whirlpool of heterogeneous opinion concerning systemic intoxication or infection from localized or circumscribed sources? This question assumes a roentgenologic aspect because through this agency is the impetus given to a considerable controversy. Since, in common with his colleagues, the reader is drawn into this maelstrom of diverse opinion, and is suspended, as it were, between centre and periphery, he is in no position to raise other than a feeble call—a mild protest which he trusts may fall upon fraternal ears, charitable as of yore. The whirlpool is rife with the howling of debate, and with the howling is the inevitable gnashing of teeth—teeth that at first glance present all the beauty of perfection, but about the root-apices of which lurks the sinister fomentation of pathogenic venom!

He of the feeble cry does not question this—indeed, he has demonstrated evidence from which it might well be deduced. So have his colleagues. But he offers this gentle query: those of us who declare that the tooth-root is the root of *all* evil, or even of *much* evil—do we not in our enthusiasm manifest a tendency to overlook or to underrate other sources of morbidity, or if we admit that other sources may exist, as well, as immediate causes of morbidity, do we not disregard the remote, and ofttimes the *basic* cause?

This query is made by one who occupies the viewpoint of the roentgenologist, and who, as such, is part and parcel in the gathering of two-thirds of the testamentary evidence, *pro* and *con*, that has embellished this controversy. As roentgenologists we have demonstrated the periapical abscess, but we may or may not agree with the assertion that it may be the primary focus of gastric ulcer (statement reported by Howe); we have revealed the pus-pocket, but we may or may not be in accord with the statement that anterior poliomyelitis is of dental origin! (Cochran, of Erie, in correspondence with the Editor of the *Dental Review*.)

Since the champions of the theory that apical infections are the prime factors in

*Read at Seventeenth Annual Meeting of the American Roentgen Ray Society, Chicago, September 27–30, 1916.

the production of general systemic or remotely localized derangement, have need of roentgenology, if not of the roentgenologist, they can but lend a patient ear or a receptive eye to all that it offers. Then, and then only will coöperation begin, and in coöperation is the real solution of this problem. Let none of us delve so deeply in one part of the field that other areas are lost to his view.

May we consider for a moment the present relationship between the dentist and the roentgenologist, or, rather, the relationship between the dentist who considers himself a practical roentgenologist and the roentgenologist who feels never more at home than when in the oral cavity? How interesting are the statements of Ottolengui of Brooklyn and of Howe of Boston, both *dental* practitioners of eminent position. Ottolengui says that while "many dental radiographers misread radiographs, it is more true that a still smaller number of medical radiographers can correctly interpret a dental radiograph." Further he says that he "would not convey the idea that there are no medical radiographers who cannot correctly read dental films, for there are many who can" (!) Toward the close of his article Dr. Ottolengui makes this statement, which has a familiar sound: "The radiograph is not a picture of disease. It is a record only of the varying resistance to the passage of the ray offered by the parts pictured." Howe makes mention of "amateur roentgenologists in search of pathological foci," etc., in speaking of certain dental endeavors in this direction.

This evident malrelationship of the dentist as a roentgenologist and the roentgenologist as a dentist can be largely adjusted by the acquisition, on the part of the roentgenologist, of more thorough dental anatomy and pathology; by the dentist, of a firmer grasp on operative roentgenology, if he feels that he must operate in an alien field. MacKee and Remer offer an adjustment when they say that the activities and observations of the one should control those of the other. This is not coöperation of the character above referred to by the reader, however, although it may do much to make possible the larger coöperation, of which more will be said.

No one can be long a student of the theory of the dental source of systemic infection without a knowledge of the work of such investigators as Rosenow or of dental authorities of the type of Hartzell and Schamberg. To pilfer time by quoting verbatim the writings of others is certainly not the purpose of this paper, but from a perusal of the communication of Howe, above referred to, as well as that of Logan, of Chicago, one may infer that there is a wide difference of opinion among the dental profession as to the dental source or systemic infection or intoxication, with especial reference to infection. On the other hand, an equal difference of feeling does not exist among dental men as to the matter of indiscriminate extraction as a therapeutic measure. It goes against the grain of the sane orthopedist, of the year 1916, to amputate for a tuberculous ankle-joint; likewise it goes against the grain of the dentist, imbued with his art, to extract teeth which in themselves possess good structural possibilities. Logan, albeit an apparent supporter of the theory of the dental source of systemic affections, advises the removal only of those teeth which cannot be controlled. Oral surgeons have told the reader that they are many times impelled to extract, willy-nilly, at the importunate requests of family physicians or medical specialists, whose hasty conclusions have been arrived at by one jump, made synchronously with the roentgenologist, amateur or otherwise; this in spite of the fact that, as Ottolengui says, the roentgenogram is not a picture of disease.

The roentgenologist cannot, with propriety, criticize adversely the dental theory of systemic infection, the tonsillar theory of systemic infection or the alimentary theory of systemic intoxication, in so far

as they go. His relationship to these theories should be of a character so basic, that although he may be entangled in the controversy, his position remains one of infinite breadth.

* * *

The writer has noticed that the cases he meets, with reference to dental disorder, correspond in a surprising majority to the type in which so much is to be expected in the way of handicaps to normal metabolism—the type to be called broadly, if you please, the *structural defective*. By many observers, as well as by him, this type, together with its antithesis, has been described, and further exposition may be unnecessary. If the appearance of this type, and the need for investigation of the dental situation are coincidental, nothing more need be said. The reader thinks otherwise, because certain interesting facts appear. In as many cases as he could with propriety do so, he has asked and has received permission to investigate the gastrointestinal situation in general. The results have been startlingly in accord with the familiar picture presented by the average abdominal viscerotic of the congenital type. The experiment was not made with the intention of correlating the viscerosis and the alveolar abnormalities as cause and effect, but as an attempt to recognize, in the predisposition to the faulty visceral adjustment, an equal predisposition to the infective oral situation. The experiment is of too meagre dimensions to prove anything, if indeed there is anything requiring proof. Every one knows that septic absorption may take place from dental sources; every one knows that toxic absorption may take place from a general or localized delay in alimentary traffic; every one knows that purulent tonsils may not confine their pathogens unto themselves. But here is a line of thought offered by a roentgenologist as an excuse for his gentle note of protest:

Our medical grandfathers were in the habit of looking at the tongues of their patients. This is a practice more rarely indulged in by our younger laboratory-trained graduates. By looking at the tongue, the practitioner of old expected to derive some inkling as to the state of the certain metabolic processes, particularly those relating to digestion. He expected to find the tongue "clean" (normal), "coated" (accumulated exfoliated epithelium in varying degree and appearance) or, perhaps "raw" (the raspberry tongue of recent complete exfoliation). These untoward appearances suggested to him certain systemic disturbances or maladjustments.

We know that the so-called coating of the tongue consists of accumulated (imperfectly exfoliated) epithelium, microorganisms and food detritus. We know that a dry, coated tongue may be a peripheral expression of a general adynamia (Butler). Therefore, imperfectly exfoliated epithelium may be a concomitant of a general adynamia.

The tonsillar epithelium likewise exfoliates, or fails to exfoliate completely, with consequent accumulations, due as well to a general adynamia and here acting as a cloak beneath which may be hidden limitless infective nidi, to say nothing of the specific structure of the tonsil, so favorable to circumscribed and concealed mischief.

Cannot there be similar aberrations from the "epithelial cycle" in the tissues of the peridental structure, where infection may find lodgment? Without question.

The adynamic conditions and consequent metabolic retardation, which inhibit the proper elimination of tissue-waste are the same that produce the deficiency in tone found repeatedly by roentgenologists in the thoracic and abdominal regions of asthenics and hyposthenics—acquired or congenital. *Acquired* adynamia may be the result of bad hygiene, faulty habits of posture, of breathing, of feeding or even of thinking. The *congenital* asthenics or hyposthenics are the viscerotics or,

if you please, the hyperontomorphs (Bean) or the carnivora (Bryant).

One can hear the practitioner say: "There is nothing new in this. It is a matter of hygiene—personal hygiene. We direct that the mouth and teeth shall be kept thoroughly clean; if the tonsil becomes infected we hear of it and treat it; and we see that our patients with a tendency to constipation have a bowel-movement once a day. Furthermore, it is a matter of common knowledge that those who are 'run down' are more liable to local infection; if they are 'run down' we 'build them up!' "

This practitioner should ask his dentist how many cases of Riggs' disease he sees in which he deplores the loosening of so many sound teeth. He should ask him if periapical abscess is not found quite unexpectedly and without apparent local cause. Does not deep dental infection occur when the oral hygiene, as practised by the patient, is scrupulous? Are not peridontal lesions at times surprisingly absent in mouths apparently dirty enough to harbor all varieties?

He hears of an infected tonsil and treats it. How many cases of acute tonsillar infection come to him and if so, what treatment does he give that removes the bacteria, and their products, that prowl about in the tonsillar catacombs? The practitioner says he is sure that old Miss X has a bowel-movement once a day, but has he ever taken the pains to find out that she has various eddying-points in her alimentary stream, made so by her typical physique, through which there is a ship-channel of great activity, but along the shores of which there is any amount of traffic, unloading its cargoes with the donkey-engine of osmosis? The practitioner says he builds up his run down patients; so he sends young Miss Y to the country to play golf and to inhale oxygen. There she lolls about with drooping shoulders and an abdomen like a Bartlett pear, and with a thoracic expansion so meagre that her lungs, although constructed for oxygenated air, could not attract hydrogen with its atomic weight of 1. The old-time relationship between tonsillitis and rheumatism has not yet been forgotten. Is it not possible that the synchronous appearance of each may have something to do with a common basic tendency, morphological or developmental? The assertion has been made that dental infection is a cause of duodenal ulcer. Why, necessarily? Visceral mal-support and asthenia go hand in hand; visceral non-support may involve the stomach; the stomach, lacking support, may drag upon the duodenum; the walls of the duodenal bulb, at least, are stretched; the stretching produces a localized anemia; anemia, in a living tissue, predisposes to degeneration—bacterial or chemical. In other words, the phagocytic or chemically-neutralizing bars are let down locally, through purely mechanical deficiency. Again, systemic asthenia, hand in hand with visceral mal-support, inhibits peripheral tissue-metabolism, exemplified in epithelial mal-exfoliation (*quod demonstratum est*) and, therefore, the soil is plowed within the alveolus for the implantation of bacteria! Thus, a not unreasonable connection between peridontal infection and duodenal ulcer!

Let roentgenologists, as contributors to the maintenance of human health, study the *habitus* of the patient, and let them stimulate the study of habitus on the part of the patient's physician. Then, perhaps, the true source, far up at the fountainhead, of systemic infection may be recognized, whether it be locally manifested in tooth, in tonsil or in the deeper alimentary system. Let our Society embrace *preventive medicine* as one of the dearest aims of modern roentgenology.

THE ROENTGEN DIAGNOSIS OF METASTATIC MALIGNANT DISEASE OF BONE, WITH SPECIAL REFERENCE TO THE SPINAL COLUMN*

BY GEORGE E. PFAHLER, M.D.

PHILADELPHIA, PA.

SO far as the study of the roentgen diagnosis of disease and tumors of the bones in general is concerned, I need only refer to the very excellent work by Rumpel,[1] but this author says very little about the tumors of the spinal column or the vertebræ, and gives no illustrations of them, nor does the roentgen literature in the English language contribute much to our knowledge of tumors of the spinal column. Therefore, in confining my remarks to the metastatic disease of bone, I will lay particular stress upon diseases within the spinal column, for you have had the privilege of studying the affections elsewhere, both from case reports and from plates exhibited at the various meetings of this society.

The most comprehensive study of tumors of the spinal column has been made by Fraenkel.[2] His studies are based upon one hundred and fifty cases that have died of carcinoma somewhere in the body, and in which he made sagittal sections of the spinal column and then roentgenograms. Some of his general statistics are of great interest. For instance, of the general cases studied, he found metastatic carcinoma in the spinal column in thirty cases, or approximately 20 per cent. In the study of ten cases of primary carcinoma in the breasts of women, he found metastasis to the spine in six, or 60 per cent. In thirty-nine cases of primary carcinoma of the stomach, he found metastasis to the spine in eight cases, or approximately 20 per cent, while in twenty-four cases of carcinoma of the uterus there was metastasis to the spinal column in only one case. He found that carcinoma of the breast in women, and carcinoma of the prostate in men, was most frequently followed by metastasis to the spinal column, but he believes that metastasis may take place in the spinal column from carcinoma anywhere in the body. Fraenkel's work was published February 2, 1911, and his work covered a period of twelve years. It far overshadows anything done in this line before or since. Other men who have made valuable contributions are Dietlen,[3] Pförringer,[4] Becker,[5] Schreiber and Israel,[6] v. Recklinghausen,[7] Heineke.[8]

Fraenkel reminds us that conclusions can only be drawn as to the frequency of metastatic carcinoma and the relative frequency following the primary disease in different parts of the body in cases that are studied roentgenographically and providing all parts of the body are studied. His work represents the only one with which I am familiar in which such an extensive study has been undertaken.

Pförringer reports two interesting cases and makes two interesting observations. In the first case, the evidence of spinal metastases was shown three years after the

[1] RUMPEL: "Über Geschwülste und entzündliche Erkrankungen der Knochen in Röntgenbild," Lucas Grafe & Sillem, Hamburg, 1908.

[2] FRAENKEL: "Über Wirbelgeschwülste im Röntgenbilde." *Fortsch. a. d. Geb. d. Roentgenstr.*, Bd. XVI, pp. 245–257. IV. Röntgen-Kongress. Verhandlg. des Hamburger Arztl. Vereins vom 24. Jan., 1899.

[3] DIETLEN: "Beitrag zum röntgenologischen Nachweis der osteoplastichen Carcinose der Wirbelsäule." *Fortschr. a. d. Geb. d. Röntgenstrahlen*, Bd. XIII, H. 1, p. 40.

[4] PFÖRRINGER: "Kasuistischer Beitrag zur Röntgendiagnostik der Wirbeltumoren." *Fortsch. a. d. Geb. d. Roentgenstr.*, 1910, Vol. XV, No. 1, p. 34.

[5] "Becker: Über Knochenkarzinose im Röntgenbild." *Fortsch. a. d. Geb. d. Roentgenstr.*, Vol. XV., No. 4, p. 24.

[6] Schreiber und Israel: "Die Röntgenstrahlen im Dienste der Neuralgie, in Furnrohr."

[7] v. Recklinghausen: Internationale Beiträge zur wissenschaftlichen Medizin, Festschrift zum 70. Geburtstag Rud. Virchows.

[8] Heineke: "Ossifizierende Sarkommetastasen im Röntgenogram." *Fortsch. a. d. Geb. d. Roentgenstr.*, Vol. XIII, No. 4, p. 231.

* Read before the Annual Meeting of the American Roentgen Ray Society in Chicago, September 27–30, 1916.

operation for carcinoma of the breast, and at autopsy it was found to be a direct extension along the second rib to the vertebra.

FIG. 1. LOWER DORSAL SPINE, SHOWING BOTH THE OSTEOCLASTIC AND OSTEOPLASTIC PROCESSES.

The 10th dorsal vertebra is compressed to a wedge shape. The lower edge of this vertebra shows decidedly the osteoclastic process, while the upper edge shows the osteoplastic process. An isolated osteoplastic nodule is distinctly shown above in the body of the 7th. All of the vertebræ are diseased.

In one of my cases spinal metastasis developed five years after operation for carcinoma of the breast without any other evidence of recurrence.

In Pförringer's second case, spinal metastasis was found fourteen days after the operation for carcinoma of the breast, and the case had been considered a comparatively early one, as only one soft axillary gland was found.

FIG. 2. AN EARLIER STAGE IN THE SAME CASE AS IN FIG. 1.

Showing the compression of the 10th dorsal vertebra, and a similar but earlier stage of the osteoclastic process in the 6th, while the exudate between the 8th and the 9th indicates an osteoplastic process.

THE GENERAL CHARACTERISTICS OF METASTATIC CARCINOMA OF THE SPINAL COLUMN

(1) There is an osteoclastic process. This consists in the destruction by the disease, wherever located, of the lime salts of the normal bone. This may take place extensively and be sharply localized, or it

may be widely distributed through the body of a vertebra or through the bodies of all of the vertebræ. For instance, one may only be able to recognize a destruction of some of the cancellous tissue, small irregular interruptions in the cancellous line, irregular spots of transparency varying in size from a pin head to the total destruction of the body of the vertebra or to the destruction of the lamina, the transverse processes, or the spinous processes independently of the body of the vertebra, or in conjunction with the bodies of the vertebræ. These localized areas of destruction may be scattered in different parts of the spinal column, or there may be a general involvement of every bone of the spinal column, or the disease may be localized in a single vertebra. Generally, this destructive process is very irregular in outline, and not sharply defined, giving the bone a worm-eaten appearance. If this softening process involves a large portion of the vertebra, it will lead to compression because of the weight of the body, and this compression furnishes one of our most characteristic signs. That is, the height of the body of the vertebra is decreased. This decrease in height may be recognized by comparing the body of the vertebra above with the one involved, when it will be found that the vertical thickness of the body of the diseased vertebra is decreased as compared with the thickness of the body of the vertebra immediately above it. It may be reduced to a mere wedge.

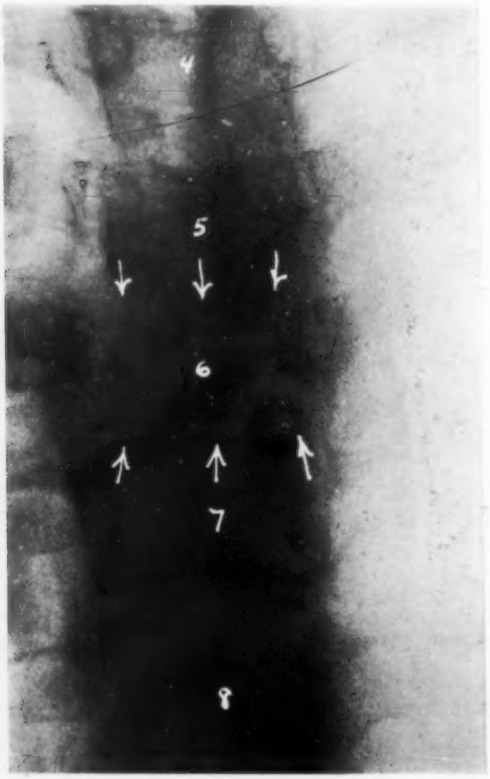

FIG. 3. METASTATIC CARCINOMA OF THE SPINE INDICATED BY THE DECREASE IN THICKNESS OF THE 6TH DORSAL VERTEBRA AS COMPARED WITH THE ONE ABOVE AND THE ONE BELOW.

Purely an osteoclastic process.

Fraenkel calls attention to the fact that normally the vertebræ are progressively thicker from above downward and that, whenever a vertebra below is thinner or has less thickness than the one above, it always means some pathology. At times this destructive process only involves the upper or the lower border of a vertebra, causing a melting away or worm-eaten appearance of the edge of the bone, so that instead of the normal, smooth, solid, uniform, ring-shaped line indicating the upper or lower vertebra this ring is seen to be interrupted. This irregular, uneven appearance is strongly suggestive of malignant disease. The metastases may involve any part of the vertebræ from the atlas to the tip of the sacrum, but Fraenkel has found that the most frequent location of the disease is in the lower dorsal and the upper lumbar. This has also been my experience. One reason that, clinically, this disease cannot be more thoroughly studied is because of the difficulty of making a careful roentgen study of this portion of the spinal column, and the roentgenogram is the only means of making an accurate diagnosis. The lower dorsal and the upper lumbar vertebræ are the most difficult of all to demonstrate clearly, and in order to demonstrate clearly the early changes of malignant disease fine details are, of course, essential. It is never safe, however, to

confine the roentgenographic studies to any particular portion of the spinal column, as the whole column must be carefully studied. In fact, to be able to eliminate metastasis to bone, a study of the entire skeleton should be made, and this study repeated at intervals, if the patient is under treatment, until all symptoms or evidence of the disease have disappeared. In a recent case the entire cervical region was diseased and no disease found elsewhere.

(2) The second general process to be observed is the osteoplastic. This is indicated by the areas which are more dense than normal bone. True sclerosis, or calcification, takes place and, like the areas of destruction, those of sclerosis or increased density may be distributed anywhere through the body of the vertebræ or in the processes, or the affection may involve the entire spinal column. This is probably an indication of nature's attempt to isolate the disease as it involves the spinal column and, of course, this sclerotic process is most frequently found in cases that develop very slowly and in which the malignant process is not especially destructive. In this group of cases the patient is apt to have suffered from malignant disease for a considerable period preceding the study of the spinal column, and at times the disease of the spinal column may give symptoms long before the primary disease has been discovered, as occurs, for instance, in connection with the prostate. Dietlen[9] reports a case in which transverse myelitis had developed before the appearance of any prostatic symptoms, and then only a moderate enlargement of the prostate was found.

Metastatic carcinoma, secondary to carcinoma of the prostate, is most likely to give rise to the osteoplastic process, and in one of the cases I studied the osteoplastic process was so marked and so general as to make me hesitate in making the diagnosis. The osteoplastic process may predominate, however, and be secondary to disease anywhere in the body. More frequently the osteoclastic and osteoplastic processes are found combined, each process being irregularly located in one vertebra or

FIG. 4. METASTATIC DISEASE OF THE SPINAL COLUMN, SHOWING INVOLVEMENT OF THE PROCESSES RATHER THAN OF THE BODIES.

[9] *Loc. cit.*

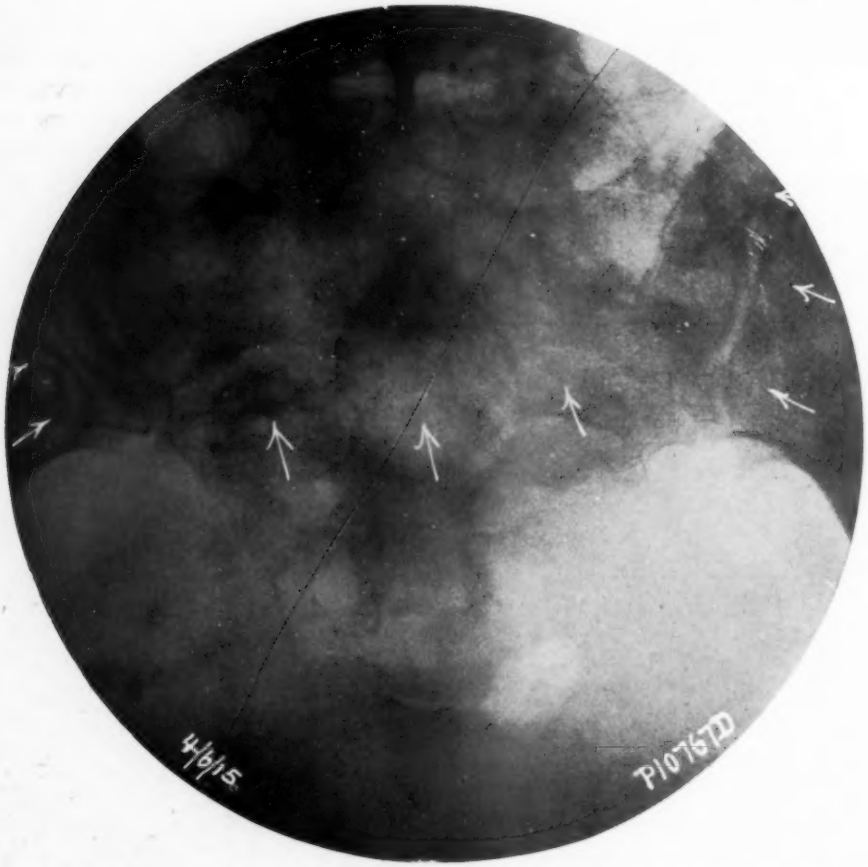

FIG. 5. EXTENSIVE METASTATIC CARCINOMA OF THE SACRUM, CHIEFLY OF THE OSTEOCLASTIC PROCESS.

throughout the vertebræ of the entire spinal column. In one case, reported by Fraenkel,[10] the process was entirely osteoclastic except for a small circular sclerotic process in one of the vertebræ, this being not more than three-eighths of an inch in diameter, entirely spherical, and sharply isolated. This osteoclastic process, as evidenced by absorption of lime salts and indicated by increased transparency of areas in the bone, is not confined to the disease in the spinal column, but this same process may be present in any of the bones of the body. So may the osteoplastic process occur anywhere, and the two are liable to occur combined. I have seen this combination in the iliac bone, in the knee joint, in the elbow joint, and in the ribs. In whatever portion of the spinal column, or in whatever portion of the skeleton the metastasis develops, it is liable to involve a considerable portion of the skeleton in the course of time. In a case reported by Becker[11] there was nothing normal about the whole skeleton. Likewise in three of my own cases almost the entire skeleton became involved. As a rule, the disease begins in the marrow of the bone or at the inner border of the cancellous structure, and extends in all directions.

DIFFERENTIAL DIAGNOSIS

I believe that we should not be compelled to make the differential diagnosis purely on the roentgen evidence. Occasionally, however, the symptoms of the primary disease are so insignificant or obscure that one is compelled to venture a

[10] *Loc. cit.*

[11] *Loc. cit.*

diagnosis purely on the roentgen evidence. If sufficient work is done a definite diagnosis can in my opinion be made from the roentgen evidence alone in the majority of cases. It is claimed that metastatic carcinoma cannot be differentiated from osteoarthritis of the spine. When these two diseases are described in general terms, the two processes are very similar, and one would be compelled to conclude that they cannot be differentiated. In both instances we have an osteoclastic process, that is, there is marked absorption of lime salts in carcinoma and in osteoarthritis, and

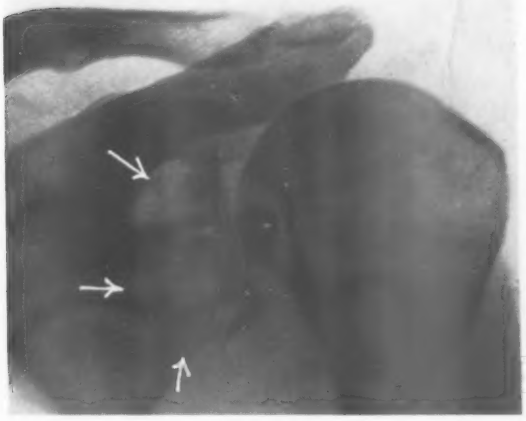

FIG. 6. METASTATIC CARCINOMA INVOLVING THE GLENOID PROCESS, WITH AN EARLY FOCUS OF DISEASE IN THE GREATER TUBEROSITY OF THE HUMERUS.

we find evidence of an osteoplastic process or of the deposit of lime salts in excess of the normal quantity in both metastatic carcinoma and osteoarthritis, but a careful study of good plates reveals this difference: In metastatic carcinoma the destructive process is due to the growth of the cells that have been deposited and are developing in the spinal column, and there are irregular small or large *areas* of localized absorption in the bone, while in osteoarthritis this absorptive process is more likely to be general and, so far as my observation goes, the osteoarthritis is not confined to a single vertebra except when it follows direct traumatism. On the other hand, in metastatic carcinoma the disease is frequently rather sharply confined to a single vertebra, while the neighboring vertebræ may have a healthy appearance. Again, in osteoarthritis, as the name implies, the disease is clearly shown to begin in the joint spaces, *i.e.* the earliest signs may be shown in the articulations; or one may detect a lipping, or exostosis, about the edges of the intervertebral spaces. Occasionally one may even find an entire bridging process across the intervertebral spaces, and yet the bodies of the vertebra may not be seriously diseased. Such cases are, of course, easily and clearly differentiated,

FIG. 7. METASTATIC CARCINOMA OF THE SHOULDER.

Showing the osteoclastic process in both the glenoid process and the entire head of the humerus, with partial absorption of both.

and a diagnosis is possible. In carcinoma, however, the disease is almost certain to be demonstrated in the body of the bone, or its processes, rather than at the edges. We all know that in osteoarthritis the earliest evidence of the disease is shown by the small exostosis or lipping process which develops at the edges of the bones. Besides, in a study of osteoarthritis of the spine, assistance will be gained from the study of the other joints, for the disease is only occasionally confined strictly to the spinal column. I believe that in all instances the history and symptoms in conjunction with a careful roentgenographic

study of the spine or the entire skeleton, will make a definite diagnosis possible.

Primary tumors of the spinal column must be differentiated from the metastatic tumor. Primary tumors of the spinal column are nearly always sarcoma, and cause a marked disturbance in the affected portion of the spinal column, as well as in the cancellous structure of the bone. The general sharp contour is lost; the shape of the body of the vertebræ may be altered; the density is generally increased so as to lack the bony appearance. The disease is rarely sharply defined, invading as it does not only the adjoining vertebra, but extending into and involving even the soft tissues. For instance, in the upper portion of the dorsal vertebræ the disease is apt to extend into the lung area, while in the lower portion of the spinal column it is found to give an increased density or tumor appearance at the side of the vertebræ. In the sacral and sacro-iliac regions, this differentiation is less clear, and yet I believe that in the majority of instances a differential diagnosis can be made between metastatic carcinoma and primary sarcoma of the sacrum and ilium. Keeping in mind the general characteristics of primary sarcoma elsewhere in the bone, one should be able to make a diagnosis of this disease in the spinal column, though it is more difficult.

FIG. 8. ADVANCED METASTATIC CARCINOMA ABOUT THE KNEE JOINT IN A CASE OF GENERAL CARCINOMATOSIS.

The isolated osteoplastic nodules in the structure of the bone are of particular interest.

Metastases of hypernephroma are in appearance very similar to those of carcinoma. In other words, a microscopical differentiation or an actual differentiation of the cellular structure can not be made. Similarly, melanoma, which belongs to the bone-marrow diseases and is more nearly related to leukemia, may closely resemble metastatic carcinoma, from which in fact one cannot be differentiated by a study of the spinal column alone. However, a careful study of the other bones, a clinical study, the history, blood-findings, etc., should render a definite diagnosis possible. Fraenkel[12] calls attention to the fact that metastasis to the spinal column from sarcoma or hypernephroma does not give rise to osteoplastic processes.

In the study of the spinal column, the appearance of the ribs should not be overlooked, as they are very often involved when the spinal column is diseased. According to my experience, the most frequent location of the metastatic process next to the spinal column seems to be in the head of the humerus, about the shoulder joints, and in the neighborhood of the hip joints.

These facts should be turned to practical account. Thus, when a patient has been operated upon for carcinoma, or when a

[12] *Loc. cit.*

diagnosis of carcinoma has been made somewhere in the body, a complaint of rather troublesome rheumatic pains, which is the most common, along the ribs, over the abdomen, or directly in the spine, should cause the physician to make a careful roentgen study of the spinal column; and when the patient complains of rheumatism in the shoulder or in the hip joints, very commonly I find that it is an indication of metastatic carcinoma. Very often these pains are first experienced shortly after taking roentgen treatment, and patients are therefore apt to attribute them to the roentgen rays, while as a matter of fact a study of the roentgen plates will demonstrate the presence of the disease long before the roentgen treatment was begun, and at times before the operation. This illustrates the advisability of making the roentgen studies before rather than after the operation. Indeed it is not an uncommon occurrence for the physician to find evidence of metastatic carcinoma, even secondary to carcinoma of the breast, before the primary disease has been discovered or complained of by the patient. Spontaneous fractures, due to secondary carcinoma, and occurring before the primary disease had been diagnosed or treated, are recognized much more frequently now that the roentgen rays assist in the definite diagnosis. Thus, I have had two cases of spontaneous fracture of the femur, which had taken place before the primary disease in the breast had been recognized. I have seen patients treated for a long time for neuritis, when their ailment was really due to metastatic carcinoma. In two instances, this metastatic carcinoma was secondary to carcinoma of the prostate. When patients complain of rheumatic pains preceding the operation, one should be very sure that the pains are not due to metastasis, for an operation under such conditions can only be looked upon as a palliative process which will accomplish little.

While the discovery of this metastatic carcinoma is generally a very bad omen, and gives rise to the worst prognosis, the case is not absolutely hopeless, for one of my patients with extensive metastatic carcinoma and, in fact, general carcinomatosis, is attending to her household duties, three years after the discovery of the trouble. I have reported a case of spontaneous fracture,[13] which healed under the usual

FIG. 9. EARLY METASTATIC CARCINOMA IN THE UPPER EXTREMITY OF THE FEMUR.

Both the patient and the attending physician supposed it to be rheumatism.

fracture treatment, under roentgenological guidance. I have had cases of metastatic carcinoma of the ribs heal so completely that the places of the erstwhile disease can hardly be recognized. The established fact of the disease, therefore, does not necessarily destroy all hope of a cure, although in my opinion general carcinomatosis must be expected, when once metastasis has taken place in the bone, and as soon as such is the case, an absolute cure can not be reasonably hoped for.

[13] "The Treatment of Malignant Disease by Means of Deep Roentgen Therapy and Electrothermic Coagulation." Illustrated by Lantern Slides. Read by invitation before the Colorado State Medical Society, September, 1916.

CONCLUSIONS

1st. Metastatic carcinoma involving bone is much more frequent than is generally recognized, and probably in the advanced stages occurs in nearly twenty per cent. of the cases.

2nd. The metastasis to the spinal column occurs in the order of frequency from mammary carcinoma in women, or prostatic carcinoma in men, carcinomata of the stomach and of the thyroid.

3rd. Rheumatic pains occurring in the presence of malignant disease should always suggest metastatic carcinoma in the spinal column or other bones and demand a thorough roentgen study.

4th. The prognosis of metastatic carcinoma of the spinal column or other bones is very bad, but not absolutely hopeless, and there may still be considerable prolongation of life with hope and comfort even after the disease has become very extensive.

5th. A healing process has been shown by me in metastatic carcinoma of bone.

RENAL AND URETERAL STONE SYMPTOMS IN SPONDYLITIS *

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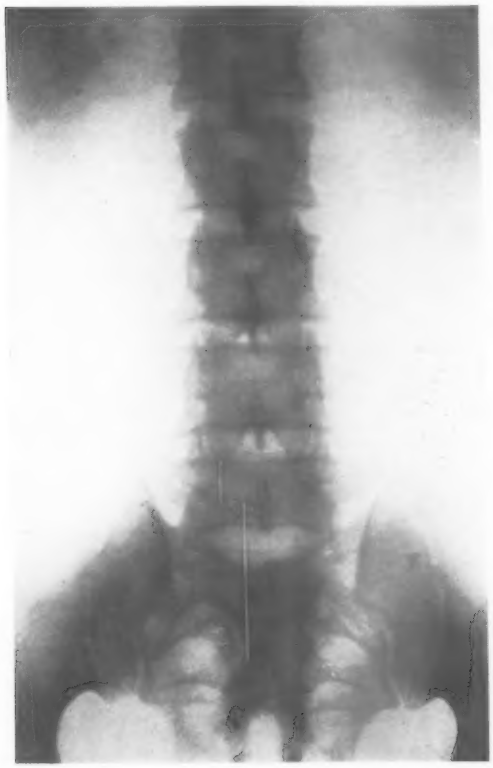
THE majority of those patients who exhibit symptoms of renal and ureteral stone find their way to the roentgenologist's office for examination. They are sent by their physician with a request "to show the stone," so that his diagnosis of nephrolithiasis may be confirmed. In most instances he is very positive that a stone is present, and we must admit that the symptoms are often more than merely suggestive. In some cases his main object is to obtain the patient's consent to an operation for removal of the stone. This often follows more readily if the roentgenogram reveals a stone shadow. But it frequently happens that disappointment awaits the physician. In certain districts the greater percentage of these cases result in a "negative *x*-ray finding" even after a careful examination, "no shadows indicating stone" being found. The physician may feel that the *x*-ray did not show up the stone because of its chemical nature or perhaps for some other reason, and therefore the *x*-ray diagnosis is discounted. In spite of a negative *x*-ray finding a few of the cases of the class under consideration go to the operating table. As a rule, exceedingly few roentgenological diagnoses, i.e., negative for stone, are found to be incorrect, and the majority of surgical reports confirm the roentgenologist's work. But we must admit that a few of these cases do have a surprisingly suggestive symptom complex pointing to renal or ureteral stone. In certain instances the signs are so complete that even blood is found in the urine and yet no stone shadows are found. However, a close analysis of the symptoms will, in most of these roentgenologically negative cases reveal the absence of one or more of the usual and characteristic signs of nephrolithiasis. Thus, the pain may not be severe enough to require opiates, or the typical Dietl's crisis may not be present, or the pain may not radiate to the genitals but to some other part, etc.

This presentation refers particularly to a group of cases which clinically simulate kidney stone but roentgenographically show no stone shadows with, however, osseous changes involving the edges of the bodies of the lumbar vertebræ, usually the

* Read at Seventeenth Annual Meeting of the American Roentgen Ray Society, Chicago, September 27–30, 1916.

upper ones. These edges are in close proximity to the kidney pelves and the upper portions of the ureters. The changes in question are revealed by shadows which are recognized as indicating spondylitis. The changes in a given case may vary in degree from a slight squaring of the corners of the vertebral bodies or "rimming," the beginning stage of hypertrophic spondylitis to the marked "hook" and "spur" and even "bridge formation" known as spondylitis deformans. In some of the cases which have come under observation, there are very distinct and clear cut erosions of the lateral portions of the bodies—a destructive spondylitis, as it were. These erosions may be so marked as to show an area of destruction of an edge of one of the bodies which is in close contact with one of the kidneys. In the consideration of a case with symptoms of renal stone in which the roentgen examination, while not revealing stone shadows, shows these osseous changes, it is logical to assume that the latter condition may be the cause of the pain as well as of other symptoms that are more or less characteristic of stone. In some of these cases such bony changes in the vertebral bodies are often overlooked or unrecognized. A careful search



CASE I.

Patient female, age 26, weight 135, sent for *x*-ray examination with clinical diagnosis of "renal stone." Roentgen diagnosis "negative for stone shadows." Illustration of approximately normal lumbosacral spine. Relation of vertebral body height to width averages 2 to 3; intervertebral spaces, regular; intervertebral articulations, normal; sacro-iliac synchondrosis, normal. The edges of the vertebral bodies may be said to show a very slight tendency toward sharpening or squaring.

(The roentgenogram shows clearly the transverse processes and edges of psoas muscles.)

CASE II.

Patient male, age 34, weight 147, sent to roentgenologist with request to "show up a renal stone present in right kidney." Complains of "sore back with considerable pain for several months"; lately became worse. At times localized on right side, at other times on left side. *X*-ray findings "negative for stone shadows; positive for hypertrophic spondylitis." Note "hook" formation at A and B; also decrease in height of vertebral bodies.

should always be made not only for stone shadows, but for all other signs of abnormality, such as those as under consideration. This is especially true when the change is not marked. Sharpened corners often indicate an early stage of hypertrophic spondylitis. Perhaps the vertebral bodies are only squared, or the height of the bodies has lessened, i.e., flattened and their breadth increased. Nevertheless these changes, slight though they may sometimes be, are potent factors for damage to the surrounding soft structures, such as the cartilage of the intervertebral discs and the adjacent muscular tissues. This may at times be sufficient to cause a tearing of these structures in which the smaller blood vessels and nerves ramify, especially if the patient performs some work requiring considerable muscular effort on the part of the spinal muscles or much bending of the spine. Some patients describe a sudden, very sharp and severe pain which gradually disappears on lying down and resting. The immobilization of the spine evidently results in stopping the trauma caused by the sharp bony points.

CASE III.

Patient female, age 36, weight 120. Clinical diagnosis "renal stone, right side." Symptoms of same. Pain sometimes acute. Condition present off and on for almost two years.

X-ray diagnosis "negative for renal stone shadows; positive for marked hypertrophic spondylitis with beginning deformities." Note hypertrophy of bone (spur) at A and localized erosions at B.

In one of the cases which prompted this article, hematuria was observed and this, together with the sudden sharp pain, was held to be due to a renal stone. The pain was almost entirely on the right side in the upper lumbar region and passed from the back, around, and toward the front of the body. It was noted that the sharp pain which was experienced did not go to the genitals, but around the body and down the thigh. The pain became worse during the day while the patient was on her feet and moving about the house, but she was not inconvenienced at night when the pain, although still present, would lessen materially. Although quite severe at times, the pain was never of sufficient intensity to require opiates, and certain postures would aggravate the pain. The patient noticed hematuria, but this occurred only once to her knowledge.

This condition lasted for several weeks, during which only one urine analysis showed blood and some albumen. A slight rise in temperature occurred during the more severe attacks, but never exceeded 100.5°. Roentgen study failed to reveal a stone shadow in any part of the urinary tract. There was, however, a distinct area indicating a very clear cut erosion of the adjacent articular surfaces of the first and second lumbar vertebræ on the right side (the side in which all the pain occurred). The edges of this eroded area were very sharp. The intervertebral space was not decreased in extent. The detail of all the bony structures was very clear, and no indication of tuberculous involvement was noticed. The other vertebræ appeared to be quite normal.

A subsequent roentgen examination was made several months after the attacks of pain had ceased. The area which had previously appeared hollowed out was now filled in by an irregular dense shadow, while the other vertebral edges which formerly were found rounded and normal were now sharpened and showed evidences

of chronic spondylitis. It is highly probable that the hematuria as well as the pain were caused by the localized erosion of bone and vertebral bodies, involving also the surrounding soft structures. The sharpened edges tore not only the neighboring tissues but also the minute blood vessels and capillaries which were traumatized to such an extent that an escape of blood resulted. This probably passed through the walls of the ureter and thus was carried into the bladder, accounting for the hematuria noticed by the patient. With rest and quiet the symptoms gradually subsided and the patient recovered without experiencing any recurrence during the past eighteen months.

In other cases the roentgen plates revealed varying degrees of spondylitis. This is of such frequent occurrence that I have come to feel that here we find an explanation for some of the cases of a negative roentgen diagnosis of stone with positive indications of spondylitis. While it is true that a few stones will escape the most careful technic, in a case which is roentgenologically negative for stone shadows but positive as to spondylitic changes as here set forth, the latter condition is likely to be the real causative factor of the symptoms complained of. The feature of hematuria previously mentioned is quite an unusual finding and is by no means necessary to establish a case of spondylitis. Nor is it to be inferred that these *x*-ray examinations are complete diagnoses in themselves, for there are other conditions in the urinary tract which can only be revealed by the cystoscope, by pyeloureterography, etc., when such cases are studied from all angles.

In many of the patients whose complaints of pain in the back are diagnosed as lumbago or similar conditions, the real cause is often found to be hypertrophic spondylitis. A lame back, some stiffness on stooping in bending the spine, occasional sharp "stitches" in the back, or indistinct soreness, will be often found on roentgen examination to have squared corners of the vertebral bodies, or a slight sharpening may be noted. As the condition becomes more marked, the vertebral bodies will seem to flatten out, their height being apparently lowered when the height is compared with the width. The proportion as seen in normal conditions is approximately 2 to 3. A further change in the progress of this condition is noted by the appearance of spicules and spurs, followed later by a bone increase sufficient to form a "bridge" from one vertebral edge to the next. This is the deforming stage, known as spondylitis deformans. The symptoms

Case IV.

Patient male, age 49, weight 158. Referred for examination for "kidney stone." Continued pain in back and kidney region for a long time; getting worse. Pain aggravated by certain postures. Has attacks suggesting Dietl's crisis. Roentgen report "negative for renal stone shadows; positive for spondylitis deformans." Note marked loss of normal outlines of lumbar vertebræ, deformities of bones, spurs, hooks, rims and hypertrophy resulting in "bridging."

are well known, but often surprisingly similar to the signs of renal or ureteral calculus.

An analysis of the roentgen findings will show that the normal vertebral bodies, as revealed by the shadows, have rounded corners and smooth, regular outlines. The apposing surfaces of the intervertebral spaces are also smooth. The upper and lower surfaces are concave toward each other, but these, too, are smooth and regu-

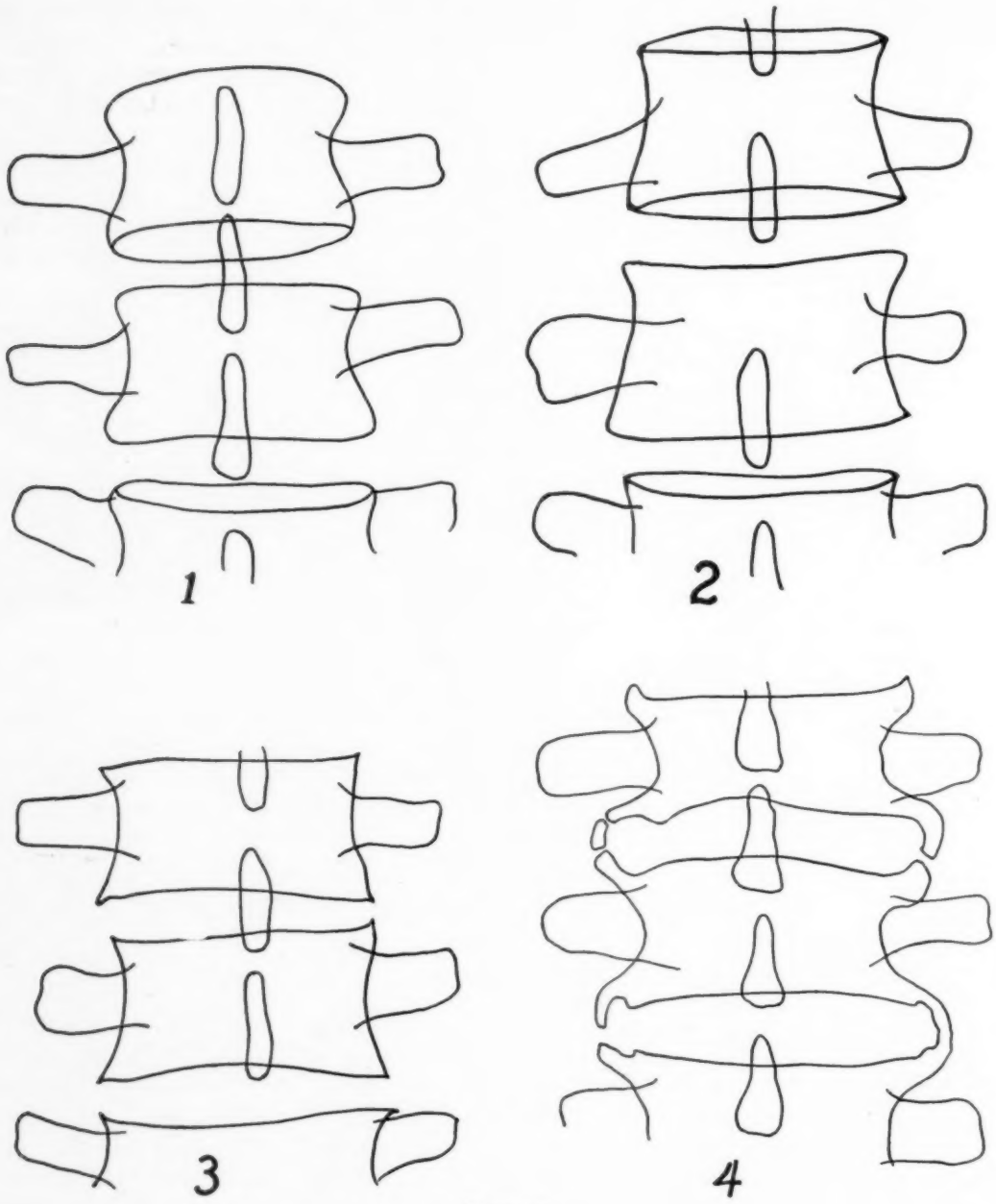


DIAGRAM.

1, Normal; 2, early stage; 3, marked degree; 4, extreme degree.

lar in outline. In the above diagram the normal outline of the lumbar vertebræ is given at figure 1. In figure 2 is presented the outline of an early stage of hypertrophic spondylitis, the corners having lost their roundness. This has resulted in "squaring" and the outlines are becoming less smooth and somewhat irregular. The next stage of spondylitis hypertrophica is seen in figure 3, where the bodies are distinctly flattened and there appears the familiar hook and spur formation. The width has apparently increased, while the height has decreased. The outlines also present some evidence of erosion as well as the opposite condition of bone increase.

The further progress of the condition is revealed in the deforming stage, or spondylitis deformans, seen in figure 4. Here the outlines have become so irregular that it is difficult to recognize the shadows as those of a vertebral body. The lessening of the height of the bodies is extreme and the corners are now so large that the hooks have grown toward each other, forming a bridge and resulting in a more or less complete ankylosis. At some points there appear to be slight fractures of these "bridges," undoubtedly a factor in causing some of the pain complained of.

These changes rarely result in an angulation or change in the alignment of the spine, the process almost always involving the entire vertebral body to an equal degree.

DISCUSSION ON PAPERS OF DRS. HICKEY, HAMMOND, BROWN, PFAHLER AND BLAINE

DR. JOHN L. PORTER, Chicago.—One point has impressed itself upon me more than any other, a point which was accentuated by each essayist, and that is the importance of closer coöperation between the roentgenologist and the clinician. The remark made by Dr. Blaine with reference to the physician who refers a case and asks the roentgenologist to show a stone brings out the point I want to make. It is unnecessary for me to call attention to the number of cases operated on for stone or appendicitis, when the patient had a tuberculosis of the lumbar spine with referred pain. Points are brought out in the roentgenogram which cannot be explained satisfactorily without a record of the clinical findings and the history. That has been impressed on me several times every week. Whenever I have an obscure case of that kind, I have the roentgenologist go over it with me and I have found that he helps me just about as often as I help him. In other words, we need not only an interpretation of the shadows, but an interpretation of the history of the patient. A closer cooperation between the clinician and roentgenologist is necessary. Just as it is impossible for the laboratory worker to make a diagnosis and prescribe the treatment when he has no opportunity of seeing the patient, just so impossible is it for the roentgenologist to tell all about the case without knowing something of the history and other findings. I am sure that you have all been impressed with the tremendous advantage accruing to the patient, the attending physician and the roentgenologist from such coöperation, and I hope that it will grow closer and closer each year.

DR. HOLLIS E. POTTER, Chicago.—During my service at the Cook County Hospital, patients were often brought to me with a clinical diagnosis of acute infectious osteomyelitis. All of the classical symptoms were present; the one thing lacking was a negative roentgen report. I have seen cases transferred from the medical to the surgical side, the surgeon making a positive diagnosis of osteomyelitis and yet being deterred from operating because some one said the roentgenogram was negative. It should be negative for the first few days, because any pathology in the bone at that time is not sufficiently well developed to show on the plate. In an acute case the roentgen ray is not worth nearly so much as ordinary pressure by the finger over the pain point in the bone. The reason is not because there is no pus there, but because there is not sufficient disintegration or breaking down of the bone to cast a shadow. That is an important point to remember. I once prepared a paper rebelling against the idea of having the surgeon wait for positive roentgen ray findings in acute

osteomyelitis. These cases should be operated on at once, irrespective of the roentgen findings, and especially with a history of acute osteomyelitis and negative roentgen findings.

DR. H. K. PANCOAST, Philadelphia.—I agree with Dr. Potter that the surgeon should not wait for a roentgen diagnosis of acute osteomyelitis before operating. I think we should educate medical students not to depend on a roentgen diagnosis of acute osteomyelitis or acute epiphysitis, because these conditions cannot be diagnosed by the roentgen ray. It has been my custom to impress students with the fact that such patients should be operated on and the foci treated days before the roentgen diagnosis is possible.

There is still some doubt in the minds of all of us as to the correctness of the diagnosis of many bone diseases, especially syphilis. We are rather prone to regard a case which we are unable to diagnose accurately, or in which we are unable to satisfy ourselves as to the correct diagnosis, as a case of syphilis. I have had a number of such experiences, the last one about a week ago, having examined the patient for supposed typhoid periostitis of the tibia about a year ago, and nothing was found, whereas last week the patient returned for another examination, and we found what seemed to be a typical syphilitic lesion of the tibia. It was simply the after effect of the typhoid periostitis and not syphilis.

DR. GEORGE C. JOHNSTON, Pittsburgh.—I saw a case recently in which the only thing which kept us from making a diagnosis of metastatic carcinoma of the spine was our inability to find the primary disease. I suggested that the lady might be syphilitic. A Wassermann test was made but was negative. I had the lady given a provocative salvarsan injection and after that they got a nice positive Wassermann reaction. The lady made a perfect recovery under antisyphilitic treatment.

Dr. Hickey's paper on the lateral examination of the spine is of extreme value. That procedure has served me well in several cases. By following out Dr. Hickey's technic and using that diaphragm as he uses it, you can make many diagnoses correctly which otherwise would be overlooked.

DR. A. B. MOORE, Rochester, Minn.—Many of these metastatic carcinoma patients have so few symptoms, usually complaining only of a little pain, that one's attention may not be directed to the real cause of the trouble. Not long ago, a patient walked into my office, climbed upon the table unassisted, and when we came to view the plates we found a marked tumor of the pelvis on the left side.

In regard to Dr. Blaine's paper, I agree with him as to the importance and necessity of studying the spine in all cases that simulate renal or ureteral stone. Nothing in medicine lies like a kidney history, and yet even with a negative urinalysis and negative roentgen findings, the kidney may be the organ involved. Other conditions than renal calculus give a classical picture of renal stone, such as hydronephrosis, obstruction of the ureter or even inflammations, and in these cases we must rely more or less upon the combined efforts of the cystoscope and the roentgen ray. Many cases of hydronephrosis on the right side have been subjected to a laparotomy. I think about 45% of these cases give a history of having had the appendix removed. That emphasizes the necessity of a thorough combined examination. Pyeloscopy and pyelography should be resorted to in every case. If we did this, the roentgenologist would not so often be blamed for not finding a stone where none exists.

DR. A. L. GRAY, Richmond, Va.—The examination of a bone during the first two or three days in a case of osteomyelitis is very much like examining the sputum

for tubercle bacilli. If you find them the patient has tuberculosis; if you fail to find them, it means nothing at all. If I fail to find any bone evidence in a case of acute osteomyelitis, I tell the clinician that it does not mean that the patient has no osteomyelitis, but that the bone structure is not yet involved and that the case should be watched and when the clinical symptoms are definite, irrespective of the roentgen findings, the proper treatment should be instituted. I recall very vividly a case I had about a year ago, a boy of 14, who suffered intense pain in the upper end of the humerus. He was referred to me for roentgen examination. I found the bone perfectly normal. He was not operated on, but local applications were made, such as ice bags, and inside of a week he had a well developed case of osteomyelitis. We cannot be too careful, in cases of so serious a nature, to make it perfectly clear that our negative findings are not actually negative.

Dr. L. G. Cole, New York City.—I agree with Dr. Potter and Dr. Gray. I remember that early in my career, after examining such a case and getting beautiful plates, I failed to detect the presence of a lesion. No operation was performed and subsequently the patient died of osteomyelitis. At that time I did not recognize the limitations of the roentgen ray in making such diagnoses.

Dr. Wm. H. Stewart, New York City.—I want to confirm Dr. Moore's statements in regard to Dr. Blaine's paper. We frequently find spondylitis deformans in cases which are examined for some urinary lesion. I have always considered this a matter of coincidence. I question whether a productive osteoarthritis of the spine could give a clinical picture simulating a nephrolithiasis unless we consider backache alone as a possible indication of a renal lesion.

Dr. A. M. Cole, Indianapolis.—I would like to have Dr. Hickey give us better details as to his technic in spine work.

Dr. Roland Hammond, Providence, R. I.—The papers have all been excellent and I want particularly to compliment Dr. Hickey on his work. I think it is very valuable. In treating tuberculosis of the spine in children, we use a curved frame so that the child is kept in hyperextension. As a rule, when roentgenograms are made of these children, especially a lateral view, the patient is taken from the frame and the back is bent forward. In this position you get no idea at all of what is being accomplished by the treatment. I have had made a wooden frame, shaped like a bow. The child is laid on this and you can get a lateral view of the spine in exactly the same position as the one in which the child is lying during the course of treatment. If you do not get good bone definition, you can at least get an idea whether or not the kyphosis is being corrected.

Dr. P. M. Hickey, Detroit, Mich.—Dr. Hammond overlooked the differential diagnosis between osteomyelitis and sarcoma. I have frequently seen mistakes made, and I think we should always bear in mind, when we find these changes next to the peritoneum, that an early sarcoma may simulate osteomyelitis so closely that a mistake in diagnosis may be made. I remember a case I saw last spring, in which a very experienced man made a diagnosis of osteomyelitis. Operation was performed, and although the material removed was not examined microscopically, cultures were made. The staphylococcus was obtained from these cultures. It was evidently a mixed infection. The case was not suspected to be one of sarcoma. I saw the patient some months later, and at that time there were metastatic nodules in the lung, the very characteristic rounded appearance of secondary sarcoma.

I was glad that Dr. Pfahler brought

out the point of suspected carcinoma of the spine in cases of painful back. Some years ago I read a paper on the spine at the Cincinnati meeting, and I suggested that all cases of painful back, occurring in people past middle age, where there was no history of trauma, should be considered possible cases of carcinoma, even though a primary growth was not present. A man was sent to the hospital for a very severe painful back. We roentgenographed the lower spine and made a tentative diagnosis of carcinoma. The surgeon accepted the diagnosis with good grace, and as the man had some stomach symptoms, he performed a laparotomy. He found the stomach healthy, but there was a small nodule in the liver, which proved to be carcinoma. The man died of primary carcinoma of the lung. It was entirely silent so far as the clinical history was concerned. The prominent symptom in his case was the pain in the lower spine.

I was also interested in Dr. Moore's discussion of Dr. Blaine's paper. Personally, I have seen cases where the findings in the kidney were perfectly normal, but we found the curve in the spine, evidently Nature's attempt to immobilize it. The lateral raying is a proposition of immobilization, and do not be in a hurry. If you are not quite sure of the tube holding out, give sufficient intervals between the flashes so as not to drop the vacuum. I made a lateral plate of the spine of a patient in bed with a small portable outfit. I allowed a minute interval between exposures, so as not to let the vacuum of the tube drop.

Dr. E. Blaine, Chicago.—The failure of the roentgen ray to show early osteomyelitis has been quite a surprise and disappointment to many of us. In these cases, I always add to the report that the *x*-ray does not show the beginning or the earliest stage of osteomyelitis, and a negative *x*-ray finding should not be considered as such. It only indicates that there has been no change in the arrangement of the mineral content of the bone; the infection may be marked in spite of this. Therefore operative intervention should not be delayed just because the roentgenogram is negative for bone shadow changes.

The *x*-ray appearances of osteocarcinomatosis is very interesting. The surprising clinical feature is the absence of generalized pain considering the extent of bone involvement. I recall a case in which the roentgenologist was asked to determine, if possible, the cause of a localized pain in the right thigh of a patient 58 years old, who, from progressive weakness, was bed-ridden. The roentgenogram showed a pathological process which was typical of bone carcinoma with a fracture, evidently pathological, of the shaft of the femur. And yet when the other bones of this patient were examined, they were seen to be riddled with similar shadows, in some areas even more marked than in the thigh. But the patient complained of no pain anywhere except at the site of the fracture.

Dr. Hickey's valuable suggestions in obtaining lateral views of the spine are timely. This view is very desirable and, in many instances, indispensable. In fact, it may be said that, without the lateral appearance being known, one will not be able in certain cases to definitely assign a diagnosis in a suspected bone lesion involving the spine of which one has only the anteroposterior view.

A SIMPLE METHOD OF IMMOBILIZATION

BY PRESTON M. HICKEY, M.D.

DETROIT, MICH.

THE question of a good technic in making roentgenograms of different parts of the body has for its basis, first, the proper understanding of the problem presented, and second, the possession of proper tools with which to do the work. In many of the laboratories which it has been the good fortune of the writer to visit, are to be found simply the transformer, a tube-stand and a paucity of accessories. While the securing of a brilliant plate is, perhaps, of very trivial importance as compared with the proper reading, still if one starts with a good plate, he is apt to express an opinion of more value than if he starts with one which is lacking in detail.

In order to secure good bone detail, the quietness of the part under examination is one of the first requisites. This may be secured by voluntary effort of the patient, by immobilization of the part above and below the area examined by means of sandbags, and by direct compression of the part in question.

It often happens, however, that the simple fact of asking the patient to concentrate his attention on keeping quiet starts up a set of involuntary movements which defeat the desired end. The use of sandbags above and below the part examined is useful, but often inefficient, and in some parts of the body, as, for example, the shoulder, is not suitable on account of anatomical irregularities. Direct compression of the part is the most efficacious means of securing immobility, but there remains the question of how this could be applied. If the compression blende is lowered directly on the part, it oftentimes causes pain from its unyielding pressure. Small pillows, stuffed with absorbent cotton, form good pads to place between the patient's skin and the compression cylinder. The ideal method, however, would be to place between the surface of the patient and the diaphragm an elastic bag which could be adjusted so that it would conform to the irregularities of the surface, and could be brought down with sufficient pressure so that the part may be accurately immobilized.

Following the suggestion of Dr. Caldwell of New York, we endeavored to make use of the rubber football, but found that this type of bag had objections on account

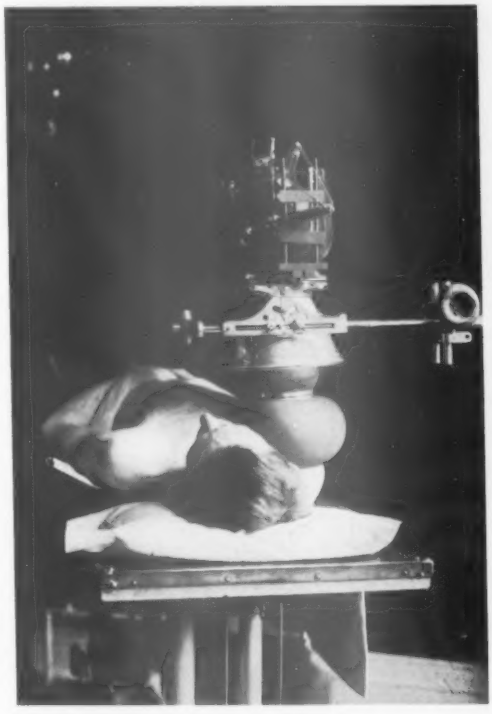


FIG. 1. ROENTGENOGRAPHING THE SHOULDER WITH THE ELASTIC BAG IN POSITION.

of the different thicknesses of the ribs of rubber, with consequent shadows upon the plate. An earnest search among the different makes of footballs failed to reveal any rubber bag with a uniform thickness of rubber. A type of hot water bottle was also tried, but did not have enough elasticity, and the thickness of the rubber was

FIG. 2. ROENTGENOGRAM OF THE SHOULDER WITH THE ELASTIC BAG AS AN ACCESSORY.
Note that the bone detail of the shoulder girdle is sharp, although the patient was allowed to breathe during the exposure.

also a detriment. The small toy balloons which are for sale in many of the five and ten cent stores or in the notion department of large department stores formed a happy solution of the problem. These rubber bags can be procured of different thicknesses and of different sizes, and when properly inflated, form an ideal method of immobilizing the part. The pressure which can be exerted through the confined air is so soft that considerable force can be applied, even to a broken bone, without causing the patient discomfort. In roentgenographing the shoulder, these rubber bags are of utmost value, inasmuch as they immobilize the shoulder without asking the patient to stop breathing.

The advantages of these bags are, first, an increase in bone detail about joints due to the thorough immobilization of the part, and, second, an increase in the definition of the soft tissues. Where formerly we considered it somewhat of an accident to obtain plates of the elbow which would show superficial veins, we now feel that unless the large veins show distinctly, the plate is below the proper standard. This demonstration of veins and soft tissues is a promise that perhaps ultimately, after we have better ideas on interpretation, soft tissue densities may give us much more valuable information.

Another advantage of the rubber bag is in stereoscopic exposures. If one lifts the compression tube so as to take off the pressure, the patient is apt to move between the first and second exposures. With the rubber bag, the pressure can be left on, and there is sufficient elasticity to allow a shifting of the cylinder without any chance of the patient moving.

While we do not feel that the above is the introduction of a new idea, inasmuch as the rubber bag has been used by many previously, still we think that the ability to use a cheap and thoroughly efficient means of compression is worthy of demonstration.

A TRIBUTE TO DR. PRESTON M. HICKEY

THE numerous friends of the founder and former editor of this Journal have very properly joined in a request for the expression of their sincere appreciation of the endeavors and achievements which stand duly chronicled in the annals of our art to the credit of Preston M. Hickey. Nothing could afford us greater satisfaction than to comply with a request for well deserved recognition which is but an echo of our own sentiments.

When, at our last Annual Meeting, Dr. Hickey tendered his resignation as Editor, we feel he must have experienced a high degree of satisfaction over the ten years of constructive work from the founding of *The American Quarterly of Roentgenology* to the rearing of this child of his multifarious ambitions to sturdy young manhood in the present shape of the Journal.

It was a lucky concatenation of circumstances that peculiarly fitted Dr. Hickey for the editorial work he chose to take up in the interests of our art. The blood of the pioneer flows in his veins, his father, the Rev. Manasseh Hickey, having been one of the pioneer missionaries among the Indians in Michigan. His editorial ability was developed in the sanctum of the Harper Hospital Bulletin, and as one of the best amateur photographers in the medical profession he was one of the first to produce satisfactory results with microphotography. As an early disciple of the roentgen ray, he, together with Dr. Shurly, purchased one of the first *x*-ray machines in the State of Michigan, and his roentgenological work on the accessory sinuses and the chest was undoubtedly pioneer investigation — at least in this part of the world.

Dr. Hickey was one of the charter members of the American Roentgen Ray Society, where he distinguished himself forging ahead with new ideas. He was one of the first to discard prints, studying the original *x*-ray plates by means of an illuminating box; he was the first to employ the giant magnet for the extraction of foreign bodies from the air passages; and at present he is perhaps the only roentgenologist who has practised the specialty of rhinology with the added development of bronchoscopy, attaining enviable skill and repute in both lines of work.

Dr. Hickey is now in the prime of his life and there is a long flight of years ahead of him in which to realize still more of his cherished ambitions. Born in Ypsilanti in 1865, Dr. Hickey attended the Detroit public schools, graduated from the Old Central High School, secured the A.B. degree in 1888 from the University of Michigan and that of M.D. in 1892 from the Detroit College of Medicine. During his undergraduate period he was a student of Dr. McGraw in surgery, and an assistant of Dr. Jennings and of Dr. E. L. Shurly in chemical and special research laboratory work.

The development of the science and art of roentgenology has necessarily been influenced by his unbounded energy, capacity for work, earnest endeavor, mechanical genius and skill in the application of the diagnostic principles of internal medicine.

To Preston Manasseh Hickey—beloved and respected by all who know him—pathologist, surgeon, roentgenologist, teacher, friend and man: many happy years of increasing usefulness!

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EDITORIALS

ROENTGENOGRAPHY IN THE DIAGNOSIS OF GAS GANGRENE

As surgical reports continue to come in from the European battle fields, more particulars are learned about gas gangrene following shot wounds, which Dr. Agnes Savill, attached to the Scottish Women's Hospital at Royaumont, France, describes in the *Archives of Radiology and Electrotherapy* for December, 1916, as the most terrible of all horrors which come under the care of the surgeon in this war.

While the affection, which is fatal in most cases, owing to the terrible rapidity with which it develops, can be clinically diagnosed without difficulty, a roentgen examination offers the additional advantage of being able in a number of cases to locate the seat and extent of the gas focus and thus guide the surgeon in selecting the most suitable place for an incision to relieve the tension. Experience has shown, however, that no reliance may be placed on negative plates, as they may have been taken at a time when there was only gas infection without gas formation or gangrene. Positive plates, however, may, according to Dr. Savill's observations, be destined to play a further and most important rôle in establishing the etiology of the disease by determining the nature of the infection which, it is hoped, may be instrumental in checking its rapid development.

In the same number of the journal just referred to, Dr. H. Martin Berry, radiologist to the Royal Herbert Military Hospital at Woolwich, describes his observations on wounded soldiers suffering from gas gangrene who had been brought from the battle field back to England for surgical treatment. Dr. Berry throws even more light on the probable nature of the infection than the former writer, and the following is a summary of the observations and conclusions of both.

According to Dr. Savill, two outstanding facts are clear: Cases arriving within twenty-four hours of being wounded are usually soon convalescent, while those wounded three or four days previously, and similarly infected, frequently succumb or live only when a limb has been removed. This would explain the different nature of

the cases Dr. Berry had to deal with, as he could in the very nature of things not see many patients in the incipient stages of the disease, while others had already been operated on abroad and the gas liberated, so that they showed no roentgenologic evidence of gas formation on examination after their arrival at a hospital for convalescents in England.

Moreover, Dr. Savill warns us that opinions at the present time form only a tentative contribution to a very complicated subject. So many factors have to be taken into consideration with each individual case that the roentgenogram is only one of the evidences for the surgeon to go on. Three distinct appearances were observed in the plates which gave positive evidence of gas and, with very few exceptions, these corresponded to three different forms of anaërobic infection. Whether this will always hold true, can only be decided by future observations. These three types are described by Dr. Savill as follows:

Type 1.—Simple swelling with a pale, misty outline which sometimes fades a little in indefinite areas. The degree of the swelling gives some evidence of the amount of infection present. This form is found when the Bac. perfringens is the chief organism, and is probably due to the edema which is usually associated with that bacillus.

Type 2.—Swelling, and, in addition, a cloud-like outline, as if the flesh were replaced by dark woolly clouds. This is due to infiltration of the tissues by the gas. Places where the gas is sharply demarcated are indicated by rounded or oval-shaped dark outlines. The diffuse cloudiness is the more common variety by far and usually associated with Bac. perfringens and Bac. sporogenes together.

Type 3.—Striation, which is subdivided into coarse and fine, and is only seen on very rare occasions. In the fine striation, dark lines of gas infiltration map out the individual muscle fibers very definitely. Coarse striation is usually associated with considerable swelling. It occurs in limited areas and the lines of division are straight and in a longitudinal direction. A number of different anaërobic organisms were found on bacteriologic examination in these cases.

Fallacies to be avoided are:

(1) Actual loss of tissue which causes a dark, irregularly outlined aspect, which may mislead the roentgenologist but not the surgeon;

(2) ecchymosis, which gives the swollen, misty and fading-away appearance resembling the common edematous perfringens infection but should not give rise to any difficulty in clinical differentiation;

(3) abscesses which may simulate gas bubbles, in which, however, the surgical indications are similar.

Dr. Savill's article is accompanied by six excellent roentgenograms illustrating the various types of gas gangrene in different stages of development.

Dr. Berry calls attention to the identical sources of error, adding, from the fact of his dealing with comparatively late cases, that oxygen bubbles may be present under considerable tension when the wound has been previously syringed with peroxid of hydrogen. As there is no means of positively differentiating these bubbles, inquiries should always be made as to whether peroxid of hydrogen has been applied.

Roentgenographically, Dr. Berry distinguishes between two main types of gas formation:

Type 1.—Where there are a comparatively small number of discrete bubbles, though individual ones may be of larger size.

Type 2.—Where there is extensive and diffuse gas infiltration. In either case the gas may be found under considerable pressure. Further experience may lead to extension of this classification.

Dr. Berry gives the clinical history of nine typical cases, accompanied by roentgenograms.

Letter from Dr. Pirie

The editor has received the following letter from a member of our Society who is serving as a medical officer in the British army in France. With the exception of a few paragraphs, the letter is reproduced *in toto*.

Nov. 7, 1916.

My Dear Case:—

I received your letter with much pleasure and am gratified to think that I have not been forgotten while I have been in France. Our experiences here have been very varied. At times we have been glad to sit around a brazier in a leaky tent while our *x*-ray plates were being glued together into a solid mass by the gentle rain which "dropped from heaven upon the place beneath," i.e., the place beneath another leaky tent. At other times we have sat in a good dry hut in easy chairs while the day's work (which might run to nearly a hundred plates) rested in a warm room in a viewing box constructed to hold one hundred at once and lighted by electric light. Some days the *x*-ray department has been busy from seven A. M. to midnight. At other times we have had so little to do that I have taken the whole hospital for a route march, as there was not a single patient to look after. Then again we would have as many as seventeen hundred wounded coming into the hospital, being fed, dressed and operated upon (naturally not all of the seventeen hundred were operated upon) as required, and evacuated in the same day. As our accommodation runs to two thousand beds, even this number of seventeen hundred, which is our record, did not disjoint the smooth running of the hospital. There have never been any scenes such as artists revel in, of the wounded being laid almost in heaps on the floor. Everyone has come in and been treated as well, if not better—and I am inclined to state that it is better—than in a civil hospital. We have specialists in every branch of surgery and medicine. In fact, when I was on sick leave in England and found that, instead of getting stronger I was growing weaker, I thought I could not do better than go back to my own hospital in order to receive the best treatment.

War's alarms do not trouble us much here. In fact, we rather welcome the occasional bomb-dropping "bosche" aeroplane that pays us a visit from time to time. His time is very limited. He appears from a cloud and is met with a shower of whistling shells which burst around him and make him dodge from side to side and, having once passed our guns, he never comes back for another taste of "Archie" as it is called.

We occasionally hear a torpedo go off and the hospital trembles to its guy ropes, but more often we see the little steamers busily sweeping up the mines that some enterprising submarine has sown during the night, taking them away to transplant them elsewhere. A naval battle is of course a rarity but we were able to watch one far off one night. I think I had better not say where, for the censor would not like it. We always have to write our letters with the thought of "What will the censor say to that," and act accordingly.

As you have learned from Dr. Dodd, the Harvard Hospital and the McGill Hospital (i.e., ours) were once side by side and we saw quite a lot of each other, medically and socially. We even met in baseball matches during the dog days when we had no patients. At these times, medical meetings were held, when nearly two hundred medical men would turn up from the surrounding country, and we listened to learned discussions on Paratyphoid B. and P. U. O. The latter term is one of the most popular diagnoses in the army. It stands for "Pyrexia of Uncertain Origin" and it covers a multitude of shortcomings which are unavoidable during times of attack and advance. The *x*-rays were in evidence at these meetings, but their use is practically only for localization of foreign bodies and to ascertain the position of fractures. There are odd cases of bone disease, tu-

mors, barium meals, etc., as in civil life, but they are in the minority. One new point in diagnosis, however, has occurred, viz., cases of gas gangrene can be diagnosed by *x*-rays and the limit of the gas infection can be shown, as the gas in the tissues gives a characteristic appearance.

Every roentgenologist knows how often he is asked to examine for fractured ribs and how seldom he finds them, but here it is the reverse. Fractured ribs are very common and are usually comminuted. . . .

There is a sad side and a gay side to all that goes on here. We work hard, when we have to, and we play hard too, when we have nothing to do. There are concerts and entertainments sent out from London, of first class artists who do much to relieve the monotony of hospital life, but we do not depend on outside talent alone. The British army includes many first class actors and in the canteens around some first class actresses can be lured away from the tea and bun counter, where all day long they do what they can to cheer up Tommy. In the evenings these people get together and put on a play that would be a credit to a London theater. But we do not even have to go outside our own hospital for amusement. When the day's work is done, or the night's work has not begun, we have twenty-five musicians, orderlies of the hospital, who have formed an orchestra and they give us a concert from time to time. Then there are neighboring hospitals to which we go when we get tired of seeing nothing but ourselves. Even the French around us are growing gay once more. When we first came we had no army to speak of, the French had certainly long faces, dancing and theaters were not thought of, were tabooed, and only after six months did one small cinema start up and struggle into existence. But lately the theaters are open and even an opera was given here last week and a joy of victory begins to pervade the air of France once more.

To return to *x*-ray work in war time, its uses are very limited but very useful. There are three essentials and the first is to be able to localize F. B.'s or to know which is the best method to use for each case. The second is to be able to make a clear plate of the thickest part of the body and the third is to have a knowledge of anatomy. The knowledge required can be taught to a layman and in many hospitals a layman does the work and does it well.

I have lately made an instrument for localizing F. B.'s which would be very useful if we had not *x*-rays in this hospital. It is worked by a small dry cell and a telephone. By its means, I can "hear" a bullet through my arm. (This was described in the December issue of our Journal.—Ed.) Whenever the instrument comes over the nearest point to the bullet a buzz takes place in the telephone which is loudest when the instrument is nearest to the F. B. I call it a "bullet buzzer" and have sent one to a casualty clearing hospital where they have no *x*-rays. The doctor there will, with its use, be able to know whether a bullet is present in a wound and where the bullet lies nearest to the surface.

Yours sincerely,

(*Signed*) A. Howard Pirie.

SOCIETY PROCEEDINGS

Chicago Roentgen Society

Regular meeting held at the Cook County Hospital, Dec. 9, 1916.

The initial number on the program was the presentation of plates with case reports.

Dr. J. T. Case exhibited plates of a case of eventration of the diaphragm; this diagnosis was essentially attained by the administration of an opaque meal. The original clinical diagnosis was dextrocardia.

Dr. Hollis E. Potter showed some unusual plates:

Case 1.—Presented shadows simulating ureteral calculi; however, a unique method of projection showed almost conclusively

that these shadows were extra-ureteral. Early history was highly suggestive of tuberculous peritonitis; therefore, it was assumed that these shadows were calcified glands.

CASE 2.—Diagnosis difficult. Patient suffered with terrific pains in back of neck, apparently behind right side of mediastinum. Pain does not radiate. No pulsation. Had had abscess attached to abdominal wall. It was drained and healed. Had hernia. Dr. Potter thought it might be an infected, broken down gland.

CASE 3.—Highly interesting because unusual. A lateral roentgenogram of the head showing a spongy network, probably osseous tumor, involving the region of the optic chiasm.

Dr. M. J. Hubeny showed three cases:

CASE 1.—A roentgenogram showing a shadow of a mole on the back; also a renal calculus. Singular, because of this occurrence in one patient.

CASE 2.—Marked syphilitic osteoporosis. Wassermann—positive.

CASE 3.—Apparently detached bone involving internal condyle of femur. Age 19; sex, male; history, negative for trauma. Repeated roentgen examinations for the past year and a half showed a quiescent condition. Alban Kohler quotes, trauma, infarct or osteochondritis dissecans as causative factors.

Roentgenograms of cases II and III will be published in a future number of this Journal.

The next regular number on the program was a paper by Dr. Fred Zapffe, which is subjoined:

THE ROENTGEN RAY IN THE DIAGNOSIS OF BONE TUMORS

BY FRED. C. ZAPFFE, M.D., F.A.C.S.

CHICAGO

Abstract. Bone tumors are common. Owing to the nature of the structures entering into the formation of bone, every variety of tumor is found in bones and in periosteum. Carcinoma, hypernephroma and thyroid cancers are always secondary in bone. All the other types of tumor are primary. The diagnosis of these tumors is not yet sufficiently well developed to make their detection always possible. Of greatest importance in the diagnosis is the clinical history, a fact which was emphasized repeatedly in all of his talks and writings by the late Dr. John B. Murphy. Trauma seems to play a great rôle in the etiology of these tumors, but perhaps we are a little too prone to read trauma into the history. However, there is no doubt that the younger the patient the greater the influence of trauma, so far as a clinical history is concerned. The location of the tumor with reference to the epiphysis must be considered also. The greatest attention should be paid to indefinite referred pains, or to any pain, in fact, for which the cause is not readily elicited. It is here that the roentgen ray is of the greatest value, but roentgenograms should be made not only early, but sufficiently often; that is, at intervals, so that when the pathology in the bone does make its appearance, the roentgen ray can detect it. If only one roentgenogram is made early in the history of the case, there may not be sufficient pathology present to be detected by the ray. A second roentgenogram, made a month later, may show the condition.

A second point to bear in mind is the fact that pain may be reflected, say to the hip, when the tumor is situated at some distance from the hip. Hence a roentgenogram of the hip would be negative, while a roentgenogram of the entire upper leg would disclose the tumor. Therefore, a sufficiently large area should be covered in the roentgen examination.

The laboratory diagnosis is third in importance in the diagnosis of bone tumors. But with improved methods of examination and with greater knowledge of the histology and pathogenesis of bone tumors this means of diagnosis bids fair to be of greater value than it now is.

Needless to say the interpretation of the roentgenogram is a matter of prime importance, because bone cysts should not

be labeled sarcomata and a sarcoma should not be called a bone cyst. The same applies to several other forms of tumors, as one type might easily be taken for another if the examination is not thorough and painstaking.

The literature contains many instances in which a malignant tumor of the bone was mistaken for a benign tumor by the roentgenologist, and the clinical history, probably because of such findings, was misinterpreted. In two instances reported by a well-known surgeon, a myositis ossificans was mistaken for sarcoma. The patient was advised to have an amputation of the leg, but fortunately in this case deferred action and consulted the surgeon referred to who made the correct diagnosis, which was confirmed by operation, thus saving the patient's limb. To make an early diagnosis of a malignant tumor, and this refers merely to sarcoma, the patient will also often be spared the loss of a limb. Sarcoma usually is of the type which permits of removal without amputation, and if this is done early recurrence rarely takes place. Metastases unfortunately do occur afterward in these cases, and inasmuch as the lung is usually the site of the metastases, a fatal termination is inevitable.

Summarizing the whole subject briefly, one may say that a good clinical history, early, repeated and sufficiently extensive roentgen examination, with prompt and proper treatment, offer a large measure of success in the treatment of bone tumors.

JAMES T. CASE, M. D.
President.
M. J. HUBENY, M. D.
Secretary.

ANNOUNCEMENT OF ANNUAL MEETING

The Eighteenth Annual Meeting of the American Roentgen Ray Society will be held in Pittsburgh, Pa., at the Hotel Schenley, Sept. 19-20-21-22, 1917.

The hotel has ideal meeting and exhibition rooms, and an excellent restaurant service. Pittsburgh is so centrally located that few of our members will require more than one night's travel to reach the meeting. It is suggested that members wishing rooms in the hotel make reservations at an early date.

H. W. VAN ALLEN,
Chairman of Executive Committee.

ANNUAL MEETING OF AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION

The next annual meeting of the American Electro-Therapeutic Association will be held at Atlantic City, New Jersey, on September 11, 12 and 13, 1917. Dr. J. Willard Travell, 27 East 11th Street, New York, is president, and Dr. Byron S. Price, 65 Central Park West, New York, is secretary.

NOTICE

The Program Committee for the Annual Meeting of the American Roentgen Ray Society, which under the Constitution is composed of the President and Secretary, desire to ask all members who have scientific papers that they wish to present before the coming annual meeting, to kindly file application for places on the program at their earliest convenience. The Program Committee further wishes to call the attention of the members desiring to present papers, to Article 8 of the Constitution, which states that "all scientific communications, to be presented to the Society at its annual meeting, must be forwarded together with an abstract of not more than two hundred words to the President at least four weeks before said meeting. If approved, said abstract is to be embodied in the printed scientific program of the annual meeting." The Program Committee desires to announce that this provision of the Constitution will be rigidly adhered to for papers that are to be read at the coming meeting.

LEWIS GREGORY COLE, President
WILLIAM H. STEWART, Secretary

Royal Society of Medicine, Section on Electrotherapeutics, London

A meeting of this section was held on October 20th, Dr. G. Harrison Orton, the President, being in the chair.

Dr. E. P. Cumberbatch showed a female patient, about 60 years of age, for the purpose of illustrating what could be accomplished by the diathermic cautery in cases of malignant disease. In 1913 she came to him with a rodent ulcer on the scalp, measuring 1 by ¾ inches in diameter. Zinc ionization, repeated six times, produced no benefit; neither did a course of *x*-ray treatments. A combination of both those methods was equally barren of results, for at the end of ten months the diameter of the ulcer had increased to 1¾ by 1½ in. Accordingly, in March, 1914, he commenced the use of diathermic cautery, cauterizing with it the edges of the ulcer and the granulations at the base. There could now be seen a central area of parietal bone occupying the base of the ulcer, and around that the tissue was apparently healthy. That greatly improved condition had persisted for a year and seven months. In treating bone cases Dr. Cumberbatch insisted on great care being taken not to allow the diathermy to damage the periosteum. Dr. W. J. Turrell, in discussing the treatment, said that no attempt should be made to treat the whole growth at once, when the wound was a large one, but that treatment should be proceeded with in stages, so that the effect of the previous application could be estimated before entering upon another.

Dr. H. A. Eccles showed, by means of the epidiascope, a valuable series of roentgenograms of fractured jaws, from a special jaw section of the large military hospital to which he was attached. Every patient was roentgenographed at the earliest opportunity after admission, and in many cases three or four records were taken to determine the effect of the treatment or the presence of sequelæ. The chief purposes served by roentgenography in jaw cases were: to diagnose fracture, to ascertain the position of the fragments before and after replacement, to ascertain whether roots of teeth were present in the fracture, their presence being a fruitful case of non-union; to determine the degree of union, the condition of the bone, and the state of the bone-graft; and to detect and localize foreign bodies. Some 60 per cent of these cases were returned to the front from the department. Several members discussed the contribution and Dr. Eccles replied.

Dr. Agnes Savill contributed a short paper on her experiences in a hospital near the firing line with cases of gas gangrene, and by means of a series of roentgenograms demonstrated the peculiar appearances seen in this terrible disease. Associated with gas gangrene were so many microörganisms that it would be difficult to assign specificity to any one of them; and pathologists were now working at the problem in order to discover the direct and the contributory causes of the two types, the localized and the massive. Of the cases admitted between July and the middle of September, 304 were found to contain the microorganisms usually found in gas gangrene, and over 100 of them presented on admission definite clinical signs of gas. At the hospital every wound was reported upon by a bacteriologist, and cases presenting clinical signs which needed surgical intervention were operated upon as soon as possible, and those which had a mixed aërobic and anaërobic infection were given operative precedence over the others. In the most severe and fatal cases the roentgenologist was able to detect a fine striation dividing the muscular fibers; it was seen only about 24 hours before death. A French worker considered that the vibrion septique was the causal organism of gas gangrene, but B. perfringens (in a large proportion), aërogenes capsulatus, sporogenes, and histolyticus had all been found in such cases. When sporogenes was present the roentgenogram showed a cloudy shadow or small bubbles. Only two of the cases of the numerous series exhibited the fine striation lines. At present the surgeon could rely upon the roentgenologist in cases of this disease in much the same way as the physician could rely upon the bacteriologist in a case of suspicious throat. A discussion followed.

New forms of apparatus were also shown.—*London Lancet*, October 28, 1916.

TRANSLATIONS & ABSTRACTS

URRUTIA, L.: Spasmodic Occlusion of the Anastomotic Mouth Causing Failure after Gastroenterostomy. (*Archives des Maladies de l'Appareil Digestif*, Vol. IX, No. 2, 1916, p. 84.)

Believing that spasmodic occlusion of the anastomotic mouth may be a cause of failure in unsuccessful gastroenterostomy, Urrutia reports a case in which the symptoms of spasm were relieved by anti-spasmodic medication. He cites some literature, especially the work of Zweig (*Archiv für Verdauungskrankheiten*, Bd. XIX, H. 6). According to Zweig, patients, in which this spasm of the anastomotic mouth is present, are of the vagatonic type with gastric hypertonicity. Zweig states these cases are rather frequent because he observed seven out of twenty-seven. Urrutia thinks this figure is exaggerated, for he has observed only one case in sixty cases of gastroenterostomy for ulcer where patients were re-examined after operation for ulcer, and a number of these were suffering with hypertonicity.

SARMENTO, F. DE MORAES. Clinical Observations on 172 Cases of Cancer of the Esophagus and Cardia. (*Archives des Maladies de l'Appareil Digestif*, Vol. IX, No. 2, 1916, p. 71.)

During the six years ending 1915, the clinic of Prof. Mathieu in Paris saw one hundred and seventy-two cases in which a diagnosis was made of cancer of the esophagus. This series included twenty-five cases of cancer of the cardia. In all cases roentgenoscopy was practised, sometimes repeatedly.

Ninety per cent. of the patients had used alcohol and tobacco excessively. In only one case was heredity a factor. Twenty-five of the cases were women. This series of one hundred and seventy-two cases of esophageal carcinoma represented 25 per cent. of the cases of cancer of the digestive tube observed in the clinic. Of the twenty-five cases of cancer of the cardia eight were secondary to a gastric neoplasm. In this series of 172 cases, 25 involved the upper third of the esophagus, 73 the middle third and 49 the lower third, while 25 involved the cardia. Glandular involvement was present in 35 cases. Visceral involvement was rare, only one case of metastasis to the liver.

Attention is drawn to the fact that dysphagia in carcinoma or esophageal stenosis is not a symptom which comes on suddenly. It is rarely intermittent. In ninety per cent. of the cases, it was regularly progressive. In only three cases could the dysphagia be considered intermittent. In seventy-five per cent. of the cases, the dysphagia became absolute for solids five or six months after the beginning of the first symptoms.

Pain is not a constant symptom, being noted 40 times out of 142 cases. The only constant symptom was exaggerated salivation (salivo-esophageal reflex of Roger). Of the physical signs, those given by roentgenoscopy and esophagoscopy are the most important. Far from being incompatible, they are complementary methods. The roentgen method should always precede the esophagoscopic study because of the possibility of the existence of an aortic lesion, which is frequently the cause of esophageal stenosis by pressure. Roentgenoscopy does not give any findings which can be truly called pathognomonic of malignancy although certain roentgen signs can be considered a great clinical aid in diagnosis. Esophagoscopy should always be done whenever possible.

The following are characteristic roentgen signs of esophageal carcinoma:

1. A hindrance, constant in location, resisting the passage of barium paste or barium mixture a long or short time, according to the intensity of the obstruction. The bismuth wafer is no longer used.

2. Dilatation, more or less marked, above the point of stenosis. This dilatation is more or less fusiform, averaging two or three finger-breadths in width, never more than four, and ends below in a narrowing, sometimes sinuous, at other times straight.

3. The presence of antiperistaltic movements.

The shape of the barium shadow in the esophagus varies, sometimes resembling a wine or champagne glass with a narrow extremity. Sometimes, one sees a very curious shadow suggesting an hour-glass condition, a more or less serrated isthmus dividing the upper pocket from the lower pocket where the barium remains for a certain period. Sometimes, the

image is very irregular but only rarely is the shadow lacunar.

The author takes into account the influence of spasm in the production of the esophageal filling defect. The sinuous appearance sometimes seen in these cases corresponds to neoplastic organic or ulcerated areas. If the radiographic findings are not conclusive one should always add esophagoscopy. Esophagoscopy was practiced in only fifteen out of one hundred and seventy-two cases.

In thirty-nine cases in which precise observations were made the duration of the disease totaled from eight months to a year after the appearance of the first suspicious symptoms.

HAMMESFAHR, KARL. Description of a "Searcher" to Determine Roentgenologically the Position of a Foreign Body Immediately Before Operation. (*Fortschr. a. d. Geb. d. Roentgenstr.*, XXIII, 5, Jan. 11, 1916, p. 423.)

Contrary to other methods which necessitate an interval between the roentgen examination

FIG. 1.

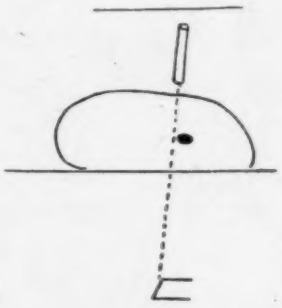

FIG. 2.

and the operation, the author's device intends to determine the position of foreign bodies at the time of operation by simple roentgenoscopy.

The searcher (Fig. 1) consists of a cylinder of ray-permeable, sterilized material which also serves as a needle holder. The needle is intended to be run into the body. There is a metal ring at each end of the cylinder, serving as a visor in aiming at the foreign body. The part harboring the foreign body is placed on a plate of any material that is permeable to the roentgen ray; below is the roentgen tube. The observations are made on an easily manageable fluorescent screen which is provided

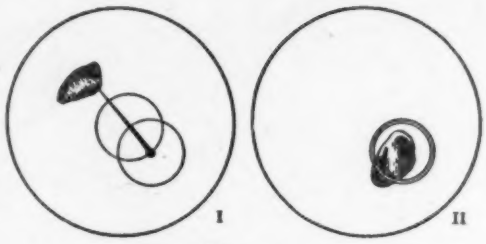

FIG. 3.

with a cardboard pyramid, held close to the eye to prevent entrance of light. The latter device need only be used if the room can not be darkened (Fig. 2).

The searcher is taken up like a penholder, and the needle is placed on the patient's skin so that the shadow of the point of the needle will appear on the shadow of the foreign body. The resulting screen picture is shown in Fig. 3. By manipulating the searcher, the shadows of foreign body and needle are brought into line, which is accomplished when the needle shadow above that of the foreign body assumes the shape of a dot and the shadows of the two metal rings cover each other (Fig. 3). The needle is now pushed in until it meets the foreign body, without allowing the shadow to be changed. If, from anatomical reasons, a special way is indicated for the insertion of the needle and the subsequent operation, a small wire ring is affixed with "matisol" at the place selected for insertion. By manipulating the roentgen tube, the shadow of the wire ring is moved till over the shadow of the foreign body and the needle is inserted in the center of the wire ring after it has been brought in line with the foreign body (Fig. 4).

If it should be impossible to insert the needle deep enough to reach the foreign body, it must at least be pushed in far enough to be firmly fixed in the tissue. The searcher is then de-

FIG. 4.

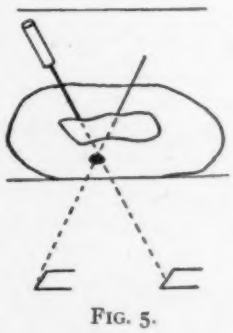

FIG. 5.

tached from the needle, the roentgen tube moved a few centimeters, and a second needle inserted in the manner described (Fig. 5). If then, at operation, both needles are advanced, they must meet upon the foreign body. The direction of the needles alone will indicate their meeting point, and the position of the foreign body may be deduced therefrom.

Being engaged in active warfare at the present moment, the author is unable to test this method in practice, nor can he follow the recent literature, but he would throw out this hint in the hope that others will find it useful during the war. The implements are supplied by Louis and H. Lewenstein, Ziegelstrasse, Berlin.

WERTHEIM-SALOMONSON. Roentgen Examination in Pleuropericarditis (Pleuropericarditis bij het Röntgenonderzoek). (*Nederl. Tijdschr. v. Geneesk.*, 1916, i, 1581.)

At the meeting of the Netherlands Society for Electrology and Roentgenology the author showed a series of pictures of normal hearts and a second series in which there were greater or less changes in the outline of the heart. The latter series were from patients who had had only vague and indefinite symptoms of heart disease. In a small group the symptoms were somewhat like those of angina pectoris, though not completely characteristic of true angina. Some of the patients had had an attack of pleuritis, and this was true of most of those who had symptoms of pseudo-angina.

In these cases the negatives showed one or more of the following three deviations from the normal: (a) A peculiar wavy and woolly appearance as if there were an irregular covering over the heart. This is a well-known sign of pleuropericarditis and has been so described by Groedel and others. (b) A peculiar hook that seemed to represent a continuation of the left heart boundary to the diaphragm. This has been described by several roentgenologists, most of whom have considered it normal. (c) Stripes that seemed to run over the heart shadow. Most observers have held that these represented the normal hilus.

The author thinks the signs described under b and c are due to thickening of the pericardium caused by old pleuropericarditis. This is not disproved by the fact that there were no symptoms of such a condition during life, for at autopsy old pericarditic changes, adhesions, etc., are often found without there having been symptoms during life. And there had been a history of pleuritis in some of these cases. Close examination of the stripes mentioned under c showed that they were not the normal hilus. Often they were some centimeters below the heart boundary and in so thin a part of the lung that they could not have been caused by the blood vessels and bronchi but must have been caused by a thickening of the pericardium, reaching to the place where the latter is attached to the diaphragm. In one case represented by one of these negatives and which came to autopsy the author was able to demonstrate that there had really been an extensive pleuropericarditis, for he could feel cord-like thickenings in the pericardium. The author thinks that the sign described under b alone, that is the thickening of the pericardial sac to the left of the apex, is enough on which to make a diagnosis of old pleuropericarditis.

Whenever there are vague heart symptoms that cannot be explained in any other way he thinks pleuropericarditis should be considered and a roentgen examination made to determine whether these signs are present. If the pleuropericardial sac is changed into a stiff, nonelastic, only slightly movable sac it makes much greater demands on the heart than if it moves with every movement of the rhythmically expanding and contracting heart, and roentgen examination is capable of demonstrating whether such a condition exists.

YOUNG, J. K. Roentgen Diagnosis of Lumbo-Sacral Region. (*Am. Jour. Orthop. Surg.*, Nov., 1916, Vol. XIV, No. 11, p. 653.)

The sacro-lumbar region is acknowledged by all to be the most difficult to study roentgenologically. This difficulty is due to the large masses of bone of different density, with their many crossing shadows. To the usual difficulties a special factor is added in the class of cases to be considered, and that is, the great size of many of the patients suffering from pathological lesions in this region. The final proof of the presence or absence, the location and extent of the disease or injury in this region, must be determined by the roentgen ray. A thorough clinical examination should always precede the roentgen examination. This ex-

amination should be most thorough, and should include not only the lumbo-sacral region—the one under consideration—but the lumbar spine, and in difficult cases the entire spine, the whole pelvis, including the hip joints.

Congenital Anomalies.—In the sacro-lumbar region congenital anomalies have long been recognized and have been fully investigated. Irregular formation of one or both transverse processes of the fifth lumbar vertebra has been frequently noted, and this deformity has been considered a frequent etiological factor on scoliosis. Indeed the irregularities of the deposit and development of the centres of the fifth lumbar vertebra are so variable that the late Professor Thomas Dwight was doubtful what should be considered normal. Congenital anomalies of the body and transverse processes of the first sacral segment are also common, and anatomists differ as to the number of segments present in the normal bone. Defects of this character are likewise responsible for a certain proportion of scoliosis.

Injuries to the Lumbo-Sacral Region.—The injuries to the lumbo-sacral region include crushing of the bodies of the vertebræ, with and without fracture and displacement of the bodies of the vertebræ.

Compression of the fifth lumbar vertebra usually results from a fall, the patient landing upon the buttocks, or from the body being overflexed or crushed down by a weight from above. The firm support of the sacrum below and the strong ligaments in the region render the fifth lumbar vertebra more liable to crushing than any of the others. If the pressure is not sufficient to cause compression, the intervertebral discs may be compressed or injured, or if the patient be a child, the epiphysis may be injured so as to interfere with the growth and produce a wedge-shaped body. Fracture of the transverse processes is not infrequently associated with compression, and the symptoms of this condition have been well described by Hartwell; they include local pain, pain on rising or sitting down, local tenderness, the limitation of motion, muscular rigidity to avoid pain on motion, scoliosis and pressure pains. Compression of the cord never occurs, because the cord terminates at the lower border of the second lumbar vertebra. The shock is out of all proportion to the amount of injury. These patients often suffer for many years before their condition is recognized, and are treated for many conditions until their symptoms become chronic. The roentgen examination shows compression of the fifth lumbar vertebra on one side, with or without fracture of the transverse process. If the process be fractured it will usually be observed projecting upward from the fractured surface, and there may be callus at the seat of fracture or later hypertrophic arthritis at the joint and in the sacro-lumbar articulation. Scoliosis is always present, and a secondary compensatory curve will be found above if the injury has existed for some time. There is no listing of the trunk to one side, as in displacement of the sacro-iliac synchondrosis. One shoulder is lowered. Displacement of the bodies of the vertebræ, and especially the fifth, not infrequently occur as a result of the injury; this may be the result of unusual physical labor, the body being held in awkward rigid positions. The rotation of the bodies may occur with or without displacement of the sacro-iliac synchondrosis.

The symptoms of displacement include: spasms of the muscles of the lumbar region; pain in the lumbar region; marked scoliosis with reflex pains, and followed by increasing disability, or complete inability to work. The roentgenogram shows marked deviation of the spine, with rotation of the bodies and compression of the intervertebral discs. If examined late, marked hypertrophic arthritis of lumbo-sacral articulation will be seen. In some instances ankylosis of the fourth or the fifth lumbar vertebra may be observed.

Diseases.—The diseases which occur in the sacro-lumbar region are arthritis deformans, various infections, and malignant diseases. The disease which is most frequently encountered in this region and which deserves the most attention is arthritis deformans. In the milder forms the articular processes show absorption, and in some cases, particularly as the result of injury, considerable deposits of new bone may be found springing from the bodies or the processes or along the course of the torn ligament. The traumatic form is the most common, and is less easily recognized because of the localized character of the deposit. The roentgen examination shows hypertrophic masses rounded and smooth, bulging from the bodies of the vertebræ, or sharp irregular exudates upon the bodies or articular processes. A rounded localized mass may easily be mistaken for sarcoma by an inexperienced

observer. The roentgenogram in the other forms is not confirmatory until actual bony changes have been evident. When present, the deposits will be seen as sharp or irregular masses upon the periphery of the articular surfaces of the bodies or upon the processes, and this distribution will be general along the entire spine and in the other articulations, especially showing through "lipping" of the edges of flat articular surfaces such as the tibia.

Tuberculosis is common in this region, the fifth lumbar vertebra being frequently affected. The rarefaction may be very extensive, including the entire sacrum and fifth lumbar vertebra, and death may occur before the disease has advanced beyond this stage. Later the roentgenogram shows area of bone destruction and absorption with necrotic islands, with or without sinus or abscess formation.

Osteomyelitis gives a characteristic appearance of rarefaction and destruction of cancellous tissue, the disease being at the time sharply limited by the articular surfaces of the individual bone, as the ilium or sacrum. In the more rapidly destructive forms of osteomyelitis, such as pneumococcic and streptococcic infections, the rarefaction and the destruction resemble tuberculosis, but the necrotic areas are larger, and there are no hypertrophic deposits to limit the process.

Specific osteomyelitis shows more sclerosis and less infiltrating destruction of the bone than occurs in acute pyogenic osteomyelitis. Moreover, the latter spreads more centrally.

Malignant disease is exceedingly rare in the sacro-lumbar region, the upper portion of the spine being more frequently affected. Both carcinoma and sarcoma are usually secondary, although the writer has recorded a case of primary sarcoma of the lumbar vertebræ.

The density of the new growth in the vertebral bodies prevents in a degree the crushing of the body commonly seen in tuberculosis, but there is absorption of the line salts with more rarely increase in the density in localized areas, with extensive, rapid, and diffuse destruction of new areas.

In sarcoma the ossification progresses in an irregular and ragged way, the effect in the roentgenogram being not uniform, but spotted, quite different from the regular bony layers observed in chronic periosteitis. The exudate also presents a smoky appearance.

The roentgenogram in malignant disease shows an irregular mottled rarefaction of the sacro-lumbar vertebræ without new bone growth, the rarefaction becoming more and more marked as the disease progresses.

Carcinoma is always secondary, and resembles sarcoma in appearance, there being less new bone growth and more destruction of bone. The clinical history is here of paramount importance.

BÉCLÈRE, A. Roentgen treatment of an Intra-Abdominal Neoplasm of Testicular Origin, (*Jour. de radiologie et d'électrologie*, Vol. II. No. 5, Sept.–Oct., 1916, p. 287.)

Béclère reports a highly interesting case of an abdominal tumor which completely disappeared under roentgen treatment, a result which he describes as the most extraordinary he has ever observed during the twelve years he has been connected with roentgenology.

In May, 1911, a 35-year-old man was referred to Béclère for roentgen treatment. The patient was a mere skeleton, and so pale, emaciated and weak that he seemed to be in the last stage of consumption and one felt indignant at the mere thought of a person in that condition being allowed to leave his bed. His weight was 64 kilos, having lost 24 kilos in the past six months. Yet his abdomen, at the greatest circumference about a finger's width below the umbilicus, measured no less than 86 cm. Palpation and percussion in the dorsal position elicited no ascites, but rather the presence of an abdominal cavity harboring a solid, hard tumor which occupied the entire left half, passed beyond the median line and extended far into the right half. From its location, the tumor seemed to be an enlarged spleen, but it differed considerably from the affection by its irregular form and especially by its uneven nodular surface. Besides, there was no leukemia, neither myeloid nor lymphatic. Anemia was present, a blood examination five months previously having shown 4,960,000 red and only 6,400 white blood corpuscles without a single myelocyte. At that time he also suffered from phlebitis of the femoral vein of the left leg (leucophlegmasia dolens).

The physical characteristics of the tumor, together with the anemia and profound cachexia, which had developed in less than a year, would have been sufficient, even without a long scar

in the left inguinal region, to make a highly probable diagnosis of malignancy. Moreover, the patient suffered from a congenitally arrested descent of the left testicle in the inguinal canal. Eight years ago, this testicle commenced to become the seat of painful crises which increased in frequency and severity. Five years later, a tumor rapidly developed in this testicle which was clinically considered malignant and surgically removed in June, 1908. The patient's condition was satisfactory for the next two years, when the growth which now fills the abdomen made its first appearance. A number of physicians and surgeons concluded that the growth was very likely an intra-abdominal recurrence of the primary neoplasm, and all agreed about its inoperability. A number of different treatments were instituted, among which were the famous cuprase injections, without arresting in the slightest the further progress of the growth and cachexia. All, except Dr. Florand, advised against roentgen treatment as useless. The author himself had little hope, but he decided to divide the abdominal skin into fields for the rays to be applied through a number of different portals, the dose to correspond to 7 and 8 Benoist through 1 mm aluminum. Two treatments per week were given in maximum doses without injury to the skin, amounting to 4 Holzknecht units per field per week.

Contrary to the author's expectations, there was such a rapid, favorable effect as he had never witnessed before. Before the third treatment was applied on the seventh day, the growth had already decreased in volume by 2 cm; the digestive function had improved, constipation was less obstinate and the appetite commenced to reappear. In another week there was a further reduction of 2 cm, accompanied by such general improvement as to allow the patient to walk six hundred yards without fatigue. At the next treatment, a further reduction was noted, the circumference of the abdomen now being 80 cm, while the body weight had increased by one kilo. The tumor no longer extended into the right half. In the course of the following month, the treatment had to be interrupted owing to a dietary indiscretion resulting in fever, and the improvement came to a corresponding standstill. The same treatment was continued for another month and then reduced to one application per week during the two following months. This brings us to the end of five months' treatment, during which the patient had regained the 24 kilos he had lost the previous year. He was now in perfect health and the splenic enlargement was not palpable. The spleen, being entirely covered up by the ribs and the costal cartilages, could be made out by percussion 5 to 6 cm transversely and 8 cm vertically. Five years have since elapsed and the condition of the patient is so excellent that he has recently joined the army.

The author, however, wishes to add, for the sake of the complete truth, that he has applied prophylactic roentgen treatment once a month from March to July, 1912, being haunted by an exaggerated fear of the edema of the left leg of four years ago becoming a source of recurrence. In November of that year, there appeared a soft subcutaneous thickening on the abdomen to which the author wrongfully applied roentgen treatment under the misapprehension of having to deal with a recurrence. The consequence was the formation of an ugly ulcer which refused to yield to treatment but finally healed under autoplastic surgery. This deplorable incident does not, in the author's opinion, lessen the success of the treatment, as the subsequent ulcer was not caused by the original affection but was a latent effect of the roentgen treatment.

The practical conclusion of this marvelous success, to use the author's words, is that in the presence of intra-abdominal neoplasms which are considered inoperable, hope should never be abandoned as long as there is a roentgen therapy to resort to.

KIRMISSON (Paris). Rapid Metastasis following Radium and Roentgen Treatment Applied to Malignant Tumors. (*Bull. med.*, July 12, 1916. Ref.: *Journ. de radiol. et d'électrol.*, Vol. II, No. 5, Sept.–Oct., 1916, p. 345.)

A wounded soldier was found to have an enormous ganglionic tumor occupying the left half of the neck. It was hard, nodular, adherent, and probably sarcomatous. The growth being inoperable, the patient was subjected to radium treatment which reduced the tumor in size. Shortly afterward, a large ganglionic tumor appeared in the left iliac fossa.

A young girl of 12 had an enormous ganglionic tumor filling the entire subclavicular triangle (periosteal sarcoma). The tumor, be-

ing inoperable, was treated with roentgen rays, the result being excellent. Shortly afterward there was a rachitic recurrence.

The author does not draw any conclusions operating against the use of radium or roentgen rays, but believes he ought to publish his experience. It would be advisable for the medical journals to devote more space to the distant results of these treatments. Nor should it be forgotten that metastases are a frequent complication of spontaneous neoplasms.

SERGENT, E. (Paris). Signs of Apical Pleuritis and Their Value in the Diagnosis of Tuberculosis in the Adult. (*Presse méd.*, Aug. 24, 1916. Ref.: *Journ. de radiol. et d'électrol.*, Vol. II, No. 5, Sept.–Oct., 1916, p. 341.)

This abstract is confined to the points of roentgenological interest.

While at autopsy apical adhesions are found very frequently, roentgenological examinations show in nearly every instance a slightly grey or opaque veil in both apices. Errors of interpretation due to inexperience of a great many observers have to be taken into consideration, such as the angle of incidence, the shadow of the clavicula, etc. But even in well observed cases there are found a large number of individuals in whom one or both apices are more or less veiled to a varying extent, without the roentgenological picture presenting any abnormal features except ganglia. In the absence of other signs, therefore, a pleural thickening may be admitted. As long as the shadow is condensed, and the cough is not relieved, it is a case of thickened symphysis; as long as the apex lights up after coughing, the lung is still permeable, but the pleural thickening which interferes with its expansion does not permit the air to enter except in forced inspiration after a cough. In an apex veiled by infiltration, the opacity must remain unchanged. Thus, the roentgen picture, like auscultation, is subject to misinterpretation and apt to lead an insufficiently trained physician to diagnose an infiltration where there is only a benign lesion or a simple scar: the vestige of an affection long forgotten. "An exact diagnosis of tuberculosis can never be made on physical methods alone whether these consist in auscultation, percussion or roentgenology." The signs thus obtained indicate the seat of the lesion, but not its character, which must be determined by general symptoms (fever, emaciation, etc.), by the tuberculin reaction, etc.

CARPENTIER. Locating Foreign Bodies with a New Instrument. (*Bull. et Mém. de la Soc. de Chir.*, July 5, 1916. Ref.: *Journ. de radiol. et d'électrol.*, Vol. II, No. 5, Sept.–Oct., 1916.)

Carpentier uses a fenestrated grill, 10 centimeters square, through which a bullet can be located (Fig. 2, 8). It is divided into 100

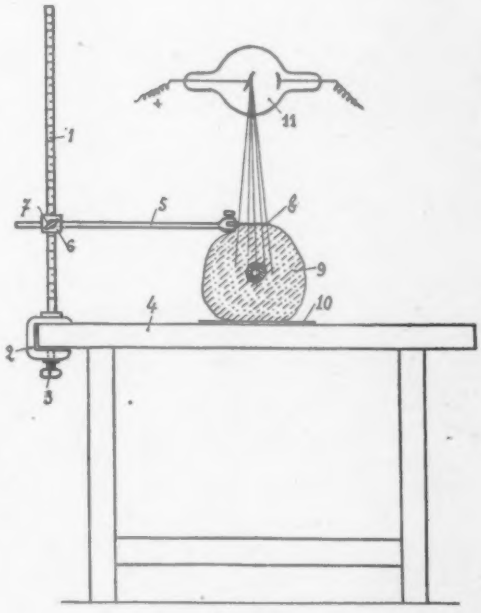

FIG. 1.

squares of 9 millimeters each. It is supported by a neck (6, 7) and a horizontal stem (*S*) which rests on a vertical support (Fig. 1, 1) marked in millimeters. The instrument is screwed with the foot end on the edge of the table (2). The patient (9) is placed on the table (4); a sensitized plate (10) is pushed under the part of the body where the bullet

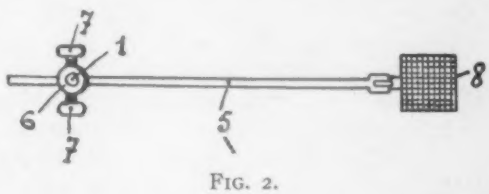

FIG. 2.

is suspected, the approximate location having been previously determined by roentgenoscopy or roentgenography. The grill is lowered until it is in contact with the body of the patient, and parallel to the plate. The outline of the grill is drawn on the skin and a radiogram is taken. The tube is placed at a carefully marked distance from the photographic plate so that the anticathode is at a distance of 50 cm. The first exposure being made, the grill is withdrawn and the position of the tube is changed according to the probable location of the bullet but always in the same plane, by 10 cm. This figure is decided upon merely because it facilitates the calculations.

A second exposure is made on the same plate. All that remains to be done is to develop and make the calculations. The two images of the bullet *A* and *B*, are marked on the plate. The depth is indicated by the formula

$$X = \frac{50 \times \text{distance between } A \text{ and } B \text{ on the plate}}{10 + \text{distance between } A \text{ and } B},$$

the value of *X* being subtracted from the figure shown by the grading of the foot piece, that is, the distance between the plate and the grill.

PIRIE, CAPTAIN A. HOWARD: The Organization of the Roentgen Department of a General Hospital in France. (*Archives of Radiol. and Electrother.*, March, 1916, p. 332.)

From Captain Pirie's description it appears that, aside from the roentgen room proper, provision has been made for a developing room, engine room and tent, but not a fluoroscopic room. The outfit was necessarily simple, the roentgen table being built from a standard table as used in the wards, with the tube box underneath. The cables were laid in an underground tunnel coming up through the floor, an upright fluoroscope was provided with rapidly working blinds and the tent was used for storage purposes. Each of two interrupterless transformers had a 10 H. P. petrol machine, a 2 KW generator and transformer. These parts were packed in four boxes, the heaviest of which weighed 490 pounds. Everything arrived in good condition save 9 of the 32 7-inch tubes.

The department opened August 8, 1915, and three days later the first machine broke down. It was replaced three months later.

Sensitized paper was used instead of plates, the radiograms being ready for inspection within half an hour. In the first three months, 1540 roentgenograms were taken, aside from many roentgenoscopic examinations. Roentgen treatment was given for sycosis, rodent ulcer and exophthalmic goiter; barium examinations were also made. No burns occurred. In 60 per cent. of the examinations foreign bodies were located, 30 per cent. were negative, while the remaining 10 per cent. were equally divided between fractures and disease. To localize foreign bodies, several methods were employed, such as the Mackenzie-Davidson (modified), the stereoscopic, fluoroscopic, Snook's modification of Sweet's, the needle contact and the metal ring placed on wound of entrance. Numerical and card indexes were kept, and there has never been a lack of any supplies. The arrangement worked as smoothly as in a large civil hospital, and the author is particularly pleased with the efficient and liberal manner in which all the necessaries were supplied.

VAN WOERT, F. J. Simplified Technic for Making Dental Radiographs. (*Dental Items of Interest*, November, 1916, Vol. XXXVIII, p. 801.)

In order to popularize among dentists the *x*-ray study of the teeth, the author of this article, with the assistance of a prominent manufacturing company, has gotten together a complete outfit, including a small eight-inch coil which can be used with either direct or alternating current, placed on end in a hardwood cabinet above a good sized electrolytic interrupter, interchangeable plug and switch which can be used from either side, and on top of the case a tube holder adjustable to any possible position of the tube. An improved Piffard tube is used, with an automatic, noiseless regulator accompanying it. This tube is made of leaded glass, with a sodium glass window.

The author believes that the most satisfactory results are obtained when the central ray strikes the film at right angles. This result cannot be secured accurately when this angle is estimated by the eye, so a simple film holder has been devised with an applicator at right angles to the holder so that whenever the film holder is held in the mouth of the patient, this applicator shows the proper angle of incidence for the central ray. An automatic time switch

operated by the foot is an important part of the apparatus.

A device which will find little appreciation among roentgenologists in general is a very ingenious system of tank development. The placing of the films in the tank is accomplished inside of a light-proof muff.

FISCHER, J. F. Roentgen Exposures in Treatment of Exophthalmic Goiter. (*Ugeskrift for Laeger*, Copenhagen, Oct. 5, 1916, Vol. LXXVIII, p. 1755. Abstr.: *Journ. Am. Med. Assn.*, Dec. 2, 1916, Vol. LXVII, p. 1706.)

Fischer remarks that roentgenotherapy seems to be far more effectual than all other measures combined, with the exception of the operative, in treatment of exophthalmic goiter. If we assume that this disease is the result of excessive thyroid secretion, it seems logical to treat it with roentgenotherapy as we know that this has a destructive action on the gland. When carried too far, cachexia strumipriva has been known to follow. Bruno-Glaserfeld's compilation of 2,032 cases of exophthalmic goiter in which thyroidectomy was done shows 82 per cent. materially improved or permanently cured. Fischer has compiled statistics of roentgenotherapy in the same disease showing 80 per cent. cured or improved, but the figures are too small for comparison. At the same time, roentgenotherapy is comparatively harmless, while operative measures show a mortality of 5.4 per cent. in Bruno-Glaserfeld's compilation, and 6 per cent. in Hildebrand's compilation from Kocher, Riedel, Klemm and Schulze clinics.

Fischer has treated with roentgen exposures 94 exophthalmic goiter patients, in his private clinic, and 37 with simple goiter. The ages ranged from 14 to 67; 8 were under 18 and 9 over 50. Only two of the 94 in the Basedow group were men. Fully 20 per cent. in this group were unable to be out of bed except as they came for treatment. The affection was from one to four years' standing as a rule. Positive benefit was obtained in from 77 to 80 per cent. of all the cases, while no improvement was evident in the others. Two of the patients claimed they felt worse after the course of treatment, but one of these was found a few months later to have much improved. A complete subsidence of all objective and subjective signs and symptoms of the exophthalmic goiter was realized in 15 cases. In the other improved cases some of the symptoms subsided while others persisted. Three especially severe cases are described in detail, with illustrations of one patient. The thyroid subsided to normal size in 22, but in fully two-thirds of the cases it became much reduced in size. The exophthalmos was the most refractory symptom, yielding most slowly if at all to treatment. It was present in 49 of the cases, and subsided completely in the course of a year in 5 and was much improved in 18, but it never retrogressed completely when excessively pronounced. Fischer gives a good historical review of the application of the roentgen rays in treatment of exophthalmic goiter. He usually gave ten sittings and then waited three months before resuming them, the entire course taking from six to twelve months. The therapeutic effect is never so prompt as after operative measures. He thinks a trial is justified even in the operable cases.

CARLSSON, P. Tuberculous Stricture of the Small Intestine. (*Hygiea*, Stockholm, Vol. LXXVIII, No. 19, p. 1502. Abstr., *Journ. Am. Med. Assn.*, Dec. 2, 1916, Vol. LXVII, p. 1706.)

Carlsson's four patients were men of 35, 44, and 54 and a woman of 50. The stretch of bowel involved was resected in three of the cases. In the older man the small intestine showed numerous ringlike strictures at intervals of about 30 cm. He had been having colic pains with distention and exaggerated peristalsis for nearly three years, with vomiting. The exploratory laparotomy revealed the serosa smooth, but with nodules near the strictures. The later were of half solid (halvfast) consistency. The mesenteric glands seemed normal. The abdomen was closed without further intervention and great improvement followed at once, but the later history is not known. The single stricture in the woman was resected. It was free and movable, like a cicatricial stricture, and for eleven years after resection of this stretch of the ileum she was in good health, free from pains. Before this she had suffered from digestive disturbances for twenty-two years, with colic pains, tympanites and exaggerated peristalsis with vomiting. Of the other

two patients one had had abdominal pains recurring during eight years, the symptoms gradually presenting Koenig's complete syndrome of tuberculous stenosis. Two tumor-like strictures were found in the lower ileum. Death occurred a year later from tuberculous peritonitis. In the fourth case there had been symptoms for only three or four months, and they were merely irregularity in bowel function, difficulty in passing flatus, and eructations. A tuberculous tumor was found in the cecum and a stricture near the valve of Bauhin. Death followed the ninth day from peritonitis, one of the sutures having given way. The fact must never be forgotten that tuberculous strictures are very likely to be multiple. The only chance of recovery is from operation. Carlsson reviews further the pathology and symptoms as described in the literature.

CULLER, R. M. Syphilis of the Stomach. (*Jour. Am. Med. Assn.*, Dec. 2, 1916, Vol. LXVII, No. 23, p. 1667.)

The author reports a case of hour-glass stomach in a man about forty-four years of age, who contracted syphilis in 1898. The initial lesion was cured by local treatment in a few days. The patient was not aware of secondaries of any kind until ten years later, when a lump appeared on his shin following traumatism. This tumor was pronounced syphilis and was treated as such for one month. Seven years later, in 1915, a severe iritis arose, with a bad corneal scar resulting. Three months of mercurial treatment were given at this time. Shortly after recovery from this he began to have "stomach trouble," consisting of indigestion, attacks of vomiting, and pain and tenderness in the epigastrium. The case was variously diagnosed, the majority of the physicians calling it gastric or duodenal ulcer. The roentgen findings showed an hour-glass contracture of the stomach, the cardiac pouch failing to empty in twenty-four hours. The Wassermann reaction before treatment was double plus. There was constant pain in the epigastrium and vomiting occurred an hour or two after taking any food whatsoever. There was no blood in the vomitus. Examination of the stomach contents was not significant except that the capacity of the stomach was very small.

A diagnosis of hour-glass contracture of the stomach due to syphilitic ulceration was made. After very thorough antisyphilitic treatment, including four doses of neosalvarsan, it was evident that the man was gradually succumbing to starvation, although his pain and other symptoms had been promptly relieved. Laparotomy revealed a prepyloric hour-glass contraction, very hard and dense, with fibrous infiltration of the greater curvature of the cardiac pouch. A partial gastrectomy was performed and recovery was uninterrupted. Postoperative study of the specimen showed no ulceration in the excised portion, but the mucous membrane was glazed and thin, indicating recent healing.

In this case, the nearer the patient approached a cure of his specific trouble, the nearer he came to death by starvation, because the healing of this great annular ulcer made the resulting fibrous ring almost an absolute obstruction to the passage of food through the stomach.

HIRTZ, G. J. Roentgen Examination of the Wounded and Search for Bullets. (*Arch. de Méd. et de Pharm. militaires*, Vol. LXV, No. 4, April, 1916. Ref.: *Journ. de Radiologie et d'électrologie*, Vol. II, No. 5, Sept.–Oct., 1916, p. 337.)

As the roentgen method is absolutely necessary for the examination of the wounded in the field, Hirtz thinks that every surgical central station should have at least one complete and independent roentgen outfit. A standard type of apparatus would be an advantage inasmuch as parts would be interchangeable. It is not enough to be ready for simple and rapid work, as cases requiring the most difficult technic have to be faced. Hirtz suggests the use of a sheet of lead, 2 mm thick and 30 or 40 cm wide, to hang from the table to within a few inches from the floor, for the protection of the operator's legs. The current used is 2 to 3 MA.

The roentgen method is employed for examining fractures and locating foreign bodies. For a complete study of the fractures, roentgenography is indispensable, as a screen observation alone may not be sufficient. Foreign bodies can often be seen roentgenoscopically, but to establish the positive presence of small particles, roentgenography is often necessary. In order to locate a bullet in the head, frontal and profile exposures will suffice, but for the trunk the depth must also be given. For this purpose Hirtz uses a screen pierced by a lead thread. In

order to obtain the position of the foreign body in relation to the skeletal plane, Hirtz employs his radiostereoscope which admits of direct stereoscopic examination of the two negatives without reduction.

To ensure unfailing extraction of a bullet, an apparatus is necessary which will guide the surgeon until he comes in direct contact with the object. The author's compass (1907) may be used for this purpose, with the roentgen tube above or below the table. There are various modifications, such as a supplementary stem, which are described. The author appends statistics of 10,000 cases he has treated with favorable results in from 95 to 100 per cent. For the brain and abdomen it is advisable to apply the extractor under guidance of the screen, or the finger-stall devised by La Baume-Pluvinelle. The true value of the various methods of extracting foreign bodies can only be learned in the operating room.

CASTRO, ALOYSIO: Visceral Inversion. (*Arch. des Maladies du Coeur*, May, 1916. Ref.: *Journ. de radiologie et d'électrologie*, Vol. II, No. 5, Sept.–Oct., 1916, p. 338.)

The author reports three cases of visceral inversion. The roentgenograms show that in one of the cases dextrocardia was associated with transposition of the liver, stomach and spleen, together with an inversion of the intestine which had not previously been noticed. As a rule, in dextrocardia the entire organ is displaced. In acquired dextrocardia the form of the electrocardiogram is the same as in a normal individual. In congenital dextrocardia the tracing shows the projections of the three large oscillations directed downward, exactly as if the picture of the normal electrocardiogram had been reversed. The three patients were tuberculous.

FIORINI and ZIRONI. Immunizing Influence of Roentgen Rays in Tuberculosis. (*Revista española de electrologia y radiologia medicas*, April, 1916. Ref.: *Journ. de radiologie et d'électrologie*, Vol. II, No. 5, Sept.–Oct., 1916, p. 338.)

The suggestion having been thrown out by Manoukhine that application of weak roentgen rays to the spleen effected a leucocytolytic change of the serum which favorably reacted on tuberculosis and certain other infectious diseases, the authors applying the identical technic arrived at opposite conclusions. They found that *in vitro* the agglutinating power and the complement deviation are identical in rayed and unrayed animals; *in vivo* not one of the tuberculous patients subjected to this treatment showed any appreciable amelioration that could be attributed to the application of the rays. The authors conclude that exciting doses, applied every three or four days to the liver or spleen, have no immunizing effect and do not influence the course of tuberculosis favorably.

CHAPUT: Accidental Discovery of Syphilitic Gummata in Roentgen Examinations. (*Bull. et Mém. de la Soc. de Chirurgie*, June, 14 and 21, 1916. Ref.: *Journ. de radiologie ét d'electrologie*, Sept.–Oct., 1916, p. 339.)

Chaput reports two cases in which latent syphilitic gummata were accidentally detected when radiograms were made of a fractured condyle. In the first case, a black oval structural lesion, 2 cm in length, was found in the axis of the femur which was visible in the fronto-lateral direction and had a serrated outline. The second case was quite similar except that the lesion was larger, measuring about 3 cm. Both seemed to be of syphilitic origin, and the author thinks it necessary, therefore, in all cases of suspected syphilis to make roentgenograms of the long bones, in order to determine the presence of certain characteristic lesions (gummata, bone cysts, osteoperiostitis, osteomyelitis with hyperostosis and lacunæ).

DE LABORIE, BRUNEAU: The Necessity of Roentgenology in Osseous Lesions. (*Paris Médical*, August 19, 1916. Ref.: *Journ. de radiologie et d'électrologie*, Vol. II, No. 5, Sept.–Oct., 1916, p. 338.)

Whenever a roentgenological screen examination fails to reveal the presence of suspected osseous lesions, it is not permissible to conclude that normal conditions are present. It is necessary in every such case to follow the examination up by roentgenography and obtain a picture.

RIST (Paris): The Principles of Rational Diagnosis of Tuberculosis. (*Presse médicale*, July 15, 1916. Ref.: *Journ. de radiologie et d'électrologie*, Vol. II, No. 5, Sept.–Oct., 1916, p. 340.)

Physicians are too often haunted by the fear of tuberculosis. When confronted with a symptom they can not at once explain, their first mental question is not: What ails the patient? but: Has he got tuberculosis? The assumption of tuberculosis leads him unconsciously to neglect positive demonstrations.

This is bad enough in times of peace, because, on the one hand, the real causes of cough and emaciation may be benign but fail to be detected. On the other hand, the diagnosis of tuberculosis is apt to upset the patient physically and mentally. In times of war, a diagnosis of tuberculosis has been and is being wrongfully made in numerous cases, causing the rejection of recruits in alarming numbers.

The author next examines into the findings of percussion and auscultation, insisting that the idea of "the supposed germination period running a course of several months or years, during which the lesion is perceptible to the ear but develops without expectoration of bacilli" is contrary to the facts. In practice, a well nourished adult European often has scars of pulmonary tuberculosis and reacts to tuberculin; he may be reinfected; but in most cases the supposed signs of the germinative period are nothing but signs of sequelæ of the first blemish. In order not to digress beyond the scope of this journal, we will leave out of consideration the findings of auscultation and percussion beyond stating that the author regards them only as indicating the processes going on in the superficial region of the lungs and revealing nothing about the changes of the central parts. The central cavities, central pneumonia, etc., may escape the best trained ear. But when the apex is involved, the first stethoscopic signs can not manifest themselves until the lesion has established itself more firmly and gained access to the superficial layers.

Roentgenology here comes to the rescue most admirably, as it shows deep and superficial lesions equally well, and the author has made a thorough study of the roentgenological potentialities in this respect which we regret we can not fully reproduce. He says in substance:

Pulmonary roentgenology demands, as does auscultation, experience and reflection. We have to learn. Standing before the screen, one has to think medicine. The errors of interpretation are due to inexperience and not to the method "in spite of what physicians say who have never been more than five consecutive minutes before the screen and rely upon the assertions of others who are equally ignorant of anatomy and physiology as of medicine." A roentgen examination may no more be omitted than auscultation and percussion: it discovers lesions which are inaccessible to the other methods. It furnishes more objective and more controllable information. There may be a difference of opinion on the bronchial character of a respiratory murmur, but two roentgenologists can not fail to agree on an opacity visible on the screen or, better still, on the plate. It shows up the condensed zones, even those of small size. Auscultation and percussion always furnish information on a region of a certain extent, so that a very small lesion is masked by the normal response of the neighboring healthy tissue. On the other hand, the roentgenogram of the same lesion will contrast so much better, the healthier the surrounding tissues are. Finally (and this is, perhaps, in Rist's opinion the most important point), a normal lung appears on the screen as indisputably normal: "we are justified in placing this objective demonstration above the more subjective and often varying or erroneous impressions which are obtained from auscultation and percussion, so far as the discovery of initial tuberculous lesions is concerned." To imagine that a pulmonary condensation capable of giving stethoscopic signs would be permeable to the roentgen rays, shows a total misconception of the physical foundations of roentgenology as well as of the examinations in question.

Passing on to the bacteriological examinations, the author again refers to the importance of the roentgen rays: Since patients often present sputum of pulmonary origin in the absence of stethoscopic signs, it may be asserted that there is a focus which is too deeply seated, but which the roentgen rays will bare without difficulty.

The author summarizes as follows: Patients may present subtle signs of a supposed period of germination, or there is a homogeneous condensation occupying nearly always several square centimeters on the screen; they do not expectorate bacilli, they feel well, and if they

should die of an intercurrent affection, they show signs of an old healed tuberculosis; or the screen may show a much more extended condensation than would have been assumed from the auscultation until an entire lobe is involved and bacilli are expectorated. These are tuberculous patients and, as applied to these, the expression of a germinative period is manifestly wrong; patients whose lungs are perfectly transparent are not tuberculous, and it is for the physician to find out some other cause for their cough. But to put them down as tuberculous is to fail in one's duty as a physician.

Percussion and auscultation serve, in the first instance, as a kind of preliminary examination or orientation; roentgenology determines the exact seat of the lesions and reveals lesions which have escaped the other methods or demonstrates the absence of lesions where none exist. Auscultation again sets in to elucidate the consistency of the lesions. Finally, a microscopic examination defines the nature of the lesion. Each of these technical steps is indispensable. In France, there are everywhere at present roentgenological and bacteriological installations. The author had an opportunity in the small station to which he was appointed, to submit every suspected soldier to a screen examination and found that rather more than one-half of their number were not tuberculous, although misapplication and misinterpretation of the signs of auscultation and percussion had marked them out to be so affected.

De La Villeon, Petit: Extraction of Bullets from the Lungs with Forceps under Guidance of the Screen. (*Presse Méd.*, July 6, 1916. Ref.: *Journ. de radiol. et d'électrol.*, Vol. II, No. 5, Sept.–Oct., 1916, p. 344.)

Clinical observation has shown that the future of individuals with bullets in their lungs is anything but bright. Hence, operation should be resorted to. The author who, he believes, was the first to practice thoracotomy in France, with healing following in all the cases, thinks that this operation should be limited to very large foreign bodies, about three times the size of a shrapnel, and to foreign bodies embedded in the hilus. In all other cases, a much simpler procedure should be resorted to: extraction with forceps under the guidance of the screen. With this technic, 51 injured have been operated upon at the hospitals at Brest, 58 projectiles being extracted. All cases healed without fever, the patients leaving their beds between the third and eighth days. The technic is as follows:

(1) Locate the bullet. This should be done by the surgeon himself so that he may have the picture in mind.

(2) Take a long straight forceps. The old model of the *tire-balle* extractor is excellent.

(3) Make a cutaneous puncture measuring 7 mm, by means of a bistouri. Push it in closed, passing through muscles, pleura and parenchyma and make sure that it loosens the projectile.

(4) Hug the foreign body, i.e., allow it to come out of its small diameter, while its uneven parts are either covered by the forceps or left behind.

(5) Follow the forceps with the roentgen rays in an oblique direction at an angle of at least 45° from the vertical. Never do a costal resection. Do not operate through the entrance of the projectile. In healthy tissue the bronchi and arterioles are pushed back and over to one side by the forceps and they will not tear.

(6) Work with leaded gloves. Do not place your hands in the bundle of rays which may easily happen on account of the oblique direction of the rays. Use hard rays.

(7) Avoid the intercostal vessels. To effect this, free the superior border from the inferior rib. Avoid the hilus. If the projectile is too near, resort to thoracopneumotomy.

Not only are the operative results excellent, but distant results for pulmonary function are perfect from both a clinical and roentgenological standpoint. The procedure tears neither the vessels nor the bronchi and does not permit of any air entering.

Ingersoll, J. M. The Practical Value of Stereoroentgenograms of the Mastoid. (*Ohio State Med. Jour.*, December, 1916, p. 796.)

Ingersoll describes four interesting cases in which stereoroentgenograms gave positive evidence in serious conditions in and around the mastoid which could not be obtained in any other way. The advantage of the stereoscopic method over flat plates is not only the addition

of the third dimension,—depth,—but also by reversing the plates in the stereoscope, the ability of looking at the mastoid from the inside as well as from the outside, thus gaining still more information. The author likens the picture to taking the temporal bone in the hand and studying the operative field from both sides, with the added value of actually looking into the mastoid antrum and cells before opening them. With this intimate study of the mastoid conditions it is possible to make an early accurate diagnosis as to the indications for surgery, the importance of which can not be overrated not only so far as immediate surgical results are concerned but also for the prognosis of speedy recovery with normal hearing in acute cases, and with less danger of labyrinth and brain infections in all cases.

In the first case reported by Ingersoll, two aurists had differed in the diagnosis: one expressing the opinion that the mastoid was infected and advising a mastoid operation; and the other thinking that the pain over the mastoid was due to a simple inflammatory process and did not indicate pus in the antrum at that time. Here was an honest difference of opinion between two good men. The author, being called in, made a stereoroentgenogram which was interpreted to show positive evidence of pus in the tip of the mastoid and also in the antrum. An immediate mastoid operation was decided upon, showing a large pneumatic mastoid with pus in the antrum and tip, and some granulation and serous secretion in the rest of the mastoid.

In the second case there had been a periodic discharge from the left ear, with tenderness over the mastoid, dizziness, nausea, vomiting and headache. The roentgenogram showed a necrotic spot over the sigmoid sinus in the median portion of the mastoid. The rest of the mastoid was necrotic. The diagnosis therefore was a probable extradural abscess by necrosis, which was confirmed by a radical mastoid operation. The fact of the latter being promptly instituted in the face of the roentgen findings, relieved the brain irritation, prevented more serious complications and brought about complete recovery.

In the third case the stereoroentgenogram helped confirm the diagnosis of brain abscess and gave some indications of its location. An immediate mastoid operation confirmed the *x*-ray findings in every particular, but the author admits that it is not always possible to diagnose and locate a brain abscess in the roentgenogram. He believes that the number of cases in which this can be successfully accomplished, will increase with greater skill in interpreting the stereoroentgenograms.

The fourth case referred to a young man who had been shot in the left eye a year previously, necessitating the enucleation of the eye. Paralysis of the right side of the face developed and a constant discharge from the right ear set in. A stereoroentgenogram showed distinctly the course of the bullet through the left orbit and the posterior ethmoid cells on the left side and the right sphenoidal sinus into the brain cavity, where it had been deflected upward into the right mastoid. It could be distinctly seen in the attic and antrum. The mastoid had large cells which were apparently normal except just around the bullet. A radical mastoid operation was done, going through normal cells until the bullet was reached and easily removed, with complete recovery following.